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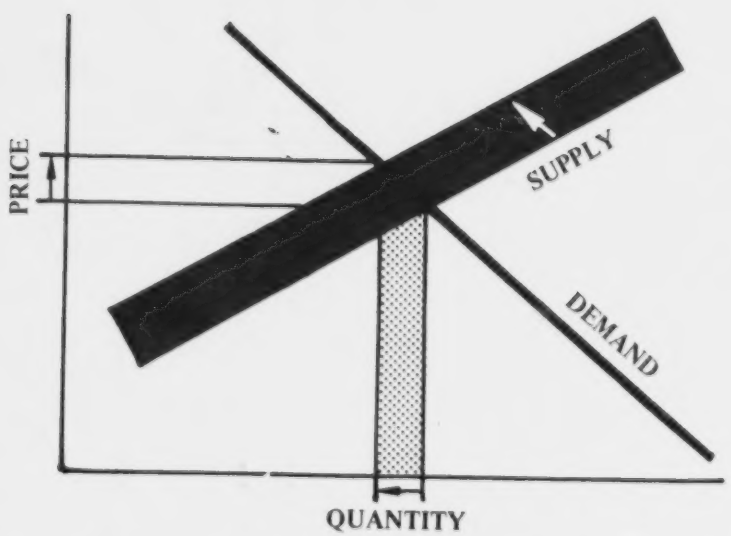

ECONOMIC IMPACT ANALYSIS OF PROPOSED EFFLUENT LIMITATIONS GUIDELINES, NEW SOURCE PERFORMANCE STANDARDS AND PRETREATMENT STANDARDS FOR THE PULP, PAPER AND PAPERBOARD MILLS POINT SOURCE CATEGORY

Volume II

Detailed Description of Product Sectors

for

U. S. Environmental Protection Agency
Office of Water Regulations and Standards
Washington, D.C. 20460

by

Meta Systems Inc
Cambridge, Massachusetts

Data Resources, Inc.
Lexington, Massachusetts

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INTRODUCTION

The following 26 memos describe each of the product sectors into which the Pulp, Paper, and Paperboard Industry has been divided for the purposes of economic impact analysis. They provide information required in Task 3, "Development of a Financial and Economic Data Base on the Industry," Part 1, "Industry Segmentation" of Exhibit "A" -- Statement of Work, October 8, 1976. Table 1 lists the 26 product sectors by production capacity. For each product sector, the following information is provided:

a. Type of firms

- o Product sector definition
- o Size, single versus multi-plant
- o Percent of total industry production capacity
- o Level of vertical and horizontal integration
- o Concentration
- o Capacity utilization rate
- o Ownership characteristics (private vs. public)
- o Major technological and/or economic trends

b. Type of mills

- o Number
- o Size
- o Age, productivity, and technological obsolescence
- o Location
- o Indirect dischargers
- o Employment
- o Planned capacity expansion

Product sector definitions are standard API definitions and are those used in the 308 Survey. Planned capacity expansion refers to all capacity expansion that was in planning or implementation stages in 1978; no completion date is assigned.

In order to protect the confidentiality of single mills, all tables entries which would reveal information about aggregates of four or less mills have been replace with an asterisk (*).

All sources are cited in abbreviated form. Full references are listed below:

Arthur D. Little, Inc., Economic Impacts of Pulp and Paper Industry Compliance with Environmental Regulation, Volume II, Price and Demand Effects on the Industry's Major Product Sectors, May 1977, Draft, EPA 230/3-76-014.

Data Resources, Inc., Pulp and Paper Review, various issues.

Data Resources, Inc., discussions with the Pulp and Paper Service Staff of the Forest Products Group.

TABLE 1. PRODUCT SECTOR BY CAPACITY

Product Sector Name	Production Capacity (Tons per Day)	Percent of Total Paper Paperboard, and Market Pulp Capacity
1. Unbleached Kraft Linerboard	42,424	20.98
2. Uncoated Freesheet	20,452	10.12
3. Coated Printing Paper	13,869	6.86
4. Semi-Chemical Corrugating Medium	13,756	6.80
5. Unbleached Kraft Paper	12,953	6.41
6. Tissue	12,792	6.33
7. Newsprint	11,691	5.78
8. Construction Paper and Board	10,682	5.28
9. Recycled Foldingboard	10,037	4.96
10. All Other Paperboard	8,137	4.02
11. Bleached Foldingboard	6,510	3.22
12. Solid Bleached Board	5,425	2.68
13. Other Market Pulp	5,057	2.50
14. Dissolving Pulp	4,495	2.22
15. Recycled Corrugating Medium	3,900	1.93
16. Uncoated Groundwood Paper	3,572	1.77
17. Bleached Kraft Paper	3,511	1.74
18. Recycled Linerboard	3,053	1.51
19. Solid Bleached Bristols	2,726	1.35
20. Special Industrial Paper	2,209	1.09
21. Thin Papers	1,716	0.85
22. Molded Pulp Products	1,033	0.51
23. All Other Paper	665	0.33
24. Glassine and Greaseproof Paper	656	0.32
25. Cotton Fibre Paper	552	0.27
26. Bleached Kraft Linerboard	315	0.16
Total Paper, Paperboard, and Market Pulp Capacity	202,188	100.00

Source: 308 Survey.

Fibre Box Association

Paper Trade Journal, published by Vance Publishing Corp., 133 E. 58th St., New York, NY 10022.

Lockwood's Directory of the Paper and Allied Trades, Vance Publishing Corporation, New York, NY, 1978.

Pulp and Paper, published by Miller Freeman Publications, 500 Howard St., San Francisco, CA 94105.

Kline Guide to the Paper and Pulp Industry, 1976.

U.S. Environmental Protection Agency Financial Survey for the Pulp, Paper and Paperboard Industry (308 Survey), 1978.

American Paper Institute, Paper, Paperboard, Woodpulp 1976-1979, Capacity Survey with Additional Data for 1980-1982, New York, NY.

E.C. Jordan Company, "Average Daily Production [of U.S. Pulp, Paper, and Paperboard Mills]," 1978.

Product Sector

Definition of Product Sector

Dissolving pulp in this report is defined as highly refined bleached sulfite or sulphate pulps with a high content of alpha (pure cellulose) fiber.

Firms in Product Sector

There are six U.S. firms that produce dissolved pulp. The major producers are:

ITT-Rayonier, Inc.
The Proctor & Gamble Co.
Alaska Lumber & Pulp Co.
International Paper Co.
Louisiana-Pacific Corp.
Weyerhaeuser Co.

Source: Meta Systems estimates based on Lockwood's, DRI estimates and E. C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 89.8 percent and the top six firms' capacity share was 100 percent. This is thus a highly concentrated product sector (Meta Systems estimates based on Lockwood's, DRI estimates, and E. C. Jordan estimates).

Total Capacity and Utilization Rate

U.S. capacity to produce dissolving pulp is 4,495 tons per day, or 2.22 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). In 1977, U.S. firms' capacity utilization rate was 95 percent (Pulp and Paper, December 1977).

Vertical Integration

All of the firms in this product sector are vertically integrated backward to raw materials (i.e., wood) (DRI estimate). No mills or 0 percent of the mills in this product sector include converting operations (308 Survey).

Horizontal Integration

The six largest firms are horizontally integrated to other economic production sectors as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
ITT-Rayonier, Inc.	51%	Public
The Proctor & Gamble Co.	15%	Public
Alaska Lumber & Pulp Co.	--	--
International Paper Co.	79%	Public
Louisiana-Pacific Corp.	12%	Public
Weyerhaeuser Co.	43%	Public

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Dissolving pulp is high purity chemical cellulose which is converted by chemical processes into rayon, cellophane, acetate, plastics, and cellulose derivatives. U.S. capacity to produce dissolving pulp has remained nearly unchanged through the 1970's. This is because U.S. demand for dissolving pulp has decreased slowly since 1974 and will continue to decrease in the future. The market for textile filament and staple rayon, two key end uses of dissolving pulp, is depressed due to excess polyester production capacity. Demand for high-tenacity rayon (tire cord) is nil. Cellophane and textile acetate production have also decreased, but acetate tow production for cigarette filters remains strong. The long-term projection of export demand is favorable.

Traditionally, the United States is a net exporter of dissolving pulps, though Canadian imports accounted, in the mid 1970's, for over ten percent of dissolving pulp consumed in the United States. Canadian firms specialize in pulp production, including dissolving pulp, for export rather than integrating to on-site paper production. This is partly because Canadian pulp can be exported duty-free while most paper products cannot, and partly because transportation costs per unit of pulp are lower than per unit of paper. Also, Canadian firms have a competitive advantage in high-grade market pulp from northern softwoods, whereas U.S. producers have competitive advantages in lower grades made from southern pine. Many domestic producers of dissolving pulp are small and specialize only in this product. (Pulp and Paper, December 1977; discussions with DRI Pulp and Paper Service staff.)

Mills

Number of Mills

The six firms in this product sector control nine mills which produce dissolving pulp. These are listed by production sub-category:

Number of Mills	Percent of Mills in This Product Sector	Production Sub-category Name
*	*	Dissolving Kraft
*	*	Dissolving Sulfite Pulp
9	100%	

Source: 308 Survey

Size

The average mill capacity is 854 tons per day, with a standard deviation of 379; the median capacity is 638 tons per day (308 Survey).

Location

Dissolving pulp producing mills are concentrated in the southeast and northwest parts of the United States with a regional breakdown as follows:

Region	Number of Mills
Northeast	0 (0%)
Southeast	* (*%)
North Central	0 (0%)
Northwest	* (*%)
West and Southwest	0 (0%)
	9

Source: 308 Survey

Indirect Dischargers

No mills in the dissolving pulp production sector are indirect dischargers (308 Survey).

Planned Capacity Expansion

There is no expected planned daily capacity expansion in the dissolving pulp product sector (308 Survey). Capacity reduction as reported in the AIP Survey from 1978 to 1982 is 40,000 tons annually (AIP Survey). Future capacity in the dissolving pulp product sector based on 308 Survey data is thus higher than that reported by AIP.

Age and Productivity

The age structure of the dissolving pulp product sector is moderately old. Most mills were built in the early to middle 1960s and none have been added since 1972. However, productivity growth in this product sector is high (4 percent per year) and the degree of technological obsolesence is low (DRI estimate). Capital investment during the past five years by mills producing in this product sector equals $518,473,000. Investment per unit capacity equals $67,000, which is high compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the Dissolving pulp product sector employed roughly 5,000 people in 1978. This represented approximately 2.0 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Market pulp in this report is defined as pulp produced for sale to pulp consumers. All types of pulp except dissolving pulp are included. This sector does not include transferred pulp, but does include shipments to affiliated mills outside the United States.

Firms in Product Sector

There are 47 U.S. firms that produce other market pulp. The major producers are:

Weyerhaeuser Co.
Scott Paper Co.
Georgia-Pacific Corp.
International Paper Co.
Crown Zellerbach Corp.
Hammermill Paper Co.
Louisiana-Pacific Corp.
Bowater, Inc.

Source: Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 42.7 percent, and the top eight firms' capacity share was 56.1 percent. This is thus an unconcentrated product sector. (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.)

Total Capacity and Utilization Rate

U.S. capacity to produce other market pulp is 5,057* tons per day, or 2.50 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). The 1979 capacity utilization rate for U.S. firms producing paper grade chemical market pulp was 89 percent (Pulp and Paper, September 1979).

Most market pulp comes from mills which have a greater pulp production capacity (constructed to achieve greater economies of scale) than paper or paperboard capacity. Over time, many mills increase their paper and/or board

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*This figure is an estimated capacity. Mill capacity allocated to market pulp may vary from year to year depending on demand considerations.

production capacity; thus, there is a continual shifting in and out of market pulp production (DRI estimate).

Vertical Integration

All of the firms in this product sector are vertically integrated backward to raw materials (i.e., wood) (DRI estimate). Twenty-one mills or 28 percent of the mills in this product sector include converting operations (308 Survey).

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors, as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Weyerhaeuser Co.	43%	Public
Scott Paper Co.	92%	Public
Georgie-Pacific Corp.	20%	Public
International Paper Co.	79%	Public
Crown Zellerbach Corp.	55%	Public
Hammermill Paper Co.	93%	Public
Louisiana-Pacific Corp.	12%	Public
Bowater, Inc.	44%	Public
ITT-Rayonier, Inc.	51%	Public
The Proctor & Gamble Co.	15%	Public
Champion International	47%	Public
Diamond International Corp.	54%	Public
Western Kraft Paper Group Willamette Industries, Inc.	53%	Public
Brown Co.	--	--
Federal Paper Board Co., Inc.	98%	Public

Source: Paper Trade Journal, June 30, 1979, pp. 44-47

Economic and Technological Trends

Economic trends and technology changes impact both production of and demand for other market pulp. The most significant technological change is the long-term substitution of bleached sulfate for bleached sulfite pulp. This is largely because bleached sulfite pulp capacity has remained static (as a result of pollution-related closures). Also, southern mills can use only Kraft pulping processes on southern pine trees, and there has been recent expansion of southern pulp mills.

Market pulp is freely traded throughout the world, and the U.S. market is highly sensitive to world market conditions. Traditionally, the United States is a net importer of paper grade pulps.

Imports of Canadian market pulp accounted, in the mid-1970s, for over 50 percent of the bleached paper grade market pulp consumed in the United States. Many Canadian pulp mills specialize in market pulp production rather than forward integrating to on-site paper production, since they have competitive advantages for high-grade pulp over U.S. mills and Canadian pulp can be exported duty-free, while most paper products cannot.

Domestically produced bleached market pulp is a residual product, since most domestic paper producers sell what they can after meeting their own papermaking requirements. Thus, if capacity is tight in the U.S. tissue, printing, and freesheet paper sectors, the supply of bleached market pulp is also likely to be tight. (ADL, 1977; DRI, Pulp and Paper Review, December 1977.)

Mills

Number of Mills

The 47 firms in this product sector control 76 mills which produce other market pulp. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*	Dissolving Kraft
8	11%	Market Bleached Kraft
8	11%	BCT Bleached Kraft
6	8%	Fine Bleached Kraft & Soda
*	*	Unbleached Kraft (Linerboard)
*	*	Semi-Chemical
*	*	Unbleached Kraft & Semi-Chemical
5	7%	Dissolving Sulfite Pulp
*	*	Papergrade Sulfite
*	*	Unbleached Kraft (Bag)
34	45%	Misc. Integrated Mills
*	*	Misc. Secondary Fiber Mills
*	*	Nonintegrated Tissue
76	100%	

Source: 308 Survey.

Size

The average mill capacity is 920 tons per day, with a standard deviation of 571, and the median capacity is 886 tons per day (308 Survey).

Locations

Many market pulp-producing mills are located in the Southeast, while other are in the Northwest and throughout the United States, with a regional breakdown as follows:

Region	Number of Mills
Northeast	8 (11%)
Southeast	35 (47%)
North Central	7 (9%)
Northwest	19 (25%)
West and Southwest	7 (9%)
	76

Source: 308 Survey.

Indirect Dischargers

Seven mills, or 9 percent of the mills in the other market pulp product sector, are indirect dischargers. The percents of mills in each region which are indirect dischargers are as follows:

Region	% of Mills
Northeast	0
Southeast	*
North Central	*
Northwest	*
West and Southwest	*

Source: 308 Survey.

Planned Capacity Expansion

Planned daily capacity expansion in the pulp product sector is expected to be 10,159 short tons per day. This represents an expansion of capacity in 60 mills. However, no all this increased capacity will necessarily go toward market pulp; the increased pulp capacity may be used to increase paper or paperboard production. A capital investment of $1,288,922,000 is planned

for this expansion. These data apply to projects which are under construction in 1978 or budgeted and approved for expenditure. (308 Survey)

Assuming 349 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion reported in response to the 308 Survey equals 3,545,000 tons annually. Capacity expansion as reported in the API Survey from 1978 to 1982 is 844,000 tons annually (API Survey). The 308 Survey reported capacity expansion for the other market pulp product sector is thus much higher than capacity expansion reported by API.

Age and Productivity

The age structure in the other market pulp product sector is fairly new with new mills coming regularly on-stream. Productivity growth in this product sector was exceptional in the 1960s and slowed considerably in the 1970s. The degree of technological obsolescence depends on the specific process used, and varies within the product sector. (Discussions with DRI Pulp and Paper Service staff, August 2, 1979.) Capital investment during the past five years by mills producing in this product sector totals $3,793,949,000. Investment per unit capacity equals $55,000, which is moderately high compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the market pulp product sector employed roughly 15,400 people in 1978. This represented approximately 6.2 percent of total pulp, paper, and papaerboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Unbleached Kraft paper is defined in this report as paper containing more than 50 percent unbleached sulfate wood pulp that is used for wrapping paper, shipping sack, bag and sack other than shipping sack, and other converting papers that are 18 pounds and over.

Firms in Product Sector

There are 29 U.S. firms that produce unbleached Kraft paper. The major producers are:

St. Regis Paper Co.
Continental Forest Industries
International Paper Co.
Union Camp Corp.
Crown Zellerbach Corp.
Georgia-Pacific Corp.
Boise Cascade Corp.
Gulf States Paper Corp.
Hudson Pulp & Paper Corp.
Longview Fibre Co.

Source: Meta Systems estimates based on Lockwood's, DRI estimates, and E. C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 52.2 percent and the top eight firms' capacity share was 66.2 percent. This is thus a moderately concentrated product sector (Meta Systems estimates based on Lockwood's, DRI estimates, and E. C. Jordan estimates).

Total Capacity and Utilization Rate

U.S. capacity to produce unbleached Kraft paper is 12,953* tons per day or 6.41 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). The 1979 capacity utilization rate was estimated at 92.3 percent (Paper Trade Journal, June 30, 1979 estimates).

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*One mill in this product sector did not report capacity data and was not included in this total.

Vertical Integration

Most of the firms in this product sector are vertically integrated (DRI estimates). Vertically integrated here means integrated from raw materials (wood, wastepaper, etc.) to converted product. Twenty mills or 44 percent of the mills in this product sector include converting operations (308 Survey).

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
St. Regis Paper Co.	82%	Public
Continental Forest Industries	22%	Public
International Paper Co.	79%	Public
Union Camp Corp.	89%	Public
Crown Zellerbach Corp.	55%	Public
Georgia-Pacific Corp.	20%	Public
Boise Cascade Corp.	53%	Public
Gulf States Paper Corp.	--	--
Hudson Pulp & Paper Corp.	90%	Public
Longview Fibre Co.	83%	Public
Champion International	47%	Public
Gilman Paper Co.	--	--
Westvaco Corp.	90%	Public
Weyerhaeuser Co.	43%	Public
Hammermill Paper Co.	93%	Public

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Shipments of unbleached Kraft papers peaked in 1974. Within this sector, shipments of unbleached Kraft wrapping and converting paper have declined in absolute terms since 1974, while shipments of shipping sack have remained constant (due in part to several mill strikes in 1978). Unbleached grocery bag and sack shipments peaked in 1978. These and shipping sacks have withstood recent plastics competition due to better packaging properties at a competitive unit cost.

Reasons why consumption of products traditionally wrapped in unbleached Kraft packaging papers has increased faster than demand for these papers include:

- o the durability of plastic wraps and bags;
- o use of lower basis weight papers;
- o the printability of plastic products; and
- o an increased proportion of total food expenditures spent on eating out.

Source: ADL, 1977; DRI, Pulp and Paper Review, December 1977, p. 55 and April 1978, pp. 49-50.

Mills

Number of Mills

The 29 firms in this product sector control 44 mills which produce unbleached Kraft paper. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
5	11%	Unbleached Kraft and Semi-Chemical
9	20%	Unbleached Kraft (Bag)
16	36%	Misc. Integrated Mills
*	*%	Deink (Tissue)
*	*%	Tissue from Wastepaper
*	*%	Paperboard from Wastepaper
*	*%	Nonintegrated Fine Papers
*	*%	Nonintegrated Paperboard
6	14%	Misc. Nonintegrated Mills
44	100%	

Source: 308 Survey.

Size

The average mill capacity is 921 tons per day, with a standard deviation of 758, and the median capacity is 886 tons per day (308 Survey).

Location

Unbleached Kraft paper producing mills are located throughout the United States, many in the southeast, with a regional breakdown as follows:

Region	Number of Mills
Northeast	7 (16%)
Southeast	20 (45%)
North Central	8 (18%)
Northwest	* (*%)
West and Southwest	* (*%)
	44

Source: 308 Survey.

Indirect Dischargers

Seven mills or 16 percent of the mills in the unbleached Kraft product sector are indirect dischargers. The percents of mills in each region which are indirect dischargers are as follows:

Region	% of Mills
Northeast	*
Southeast	*
North Central	*
Northwest	*
West and Southwest	0

Source: 308 Survey.

Planned Capacity Expansion

Planned daily capacity expansion in the unbleached Kraft product sector is expected to be 149 short tons per day. This represents an expansion of capacity in four mills. This expansion will be an increase of 1.2 percent in the capacity to produce unbleached Kraft paper by all mills. A capital investment of $14,079,000 is planned for this expansion. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure. (308 Survey)

Assuming 356 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion reported in response to the 308 Survey equals 53,000 tons annually.

Capacity expansion as reported in the API Survey from 1978 to 1982 is 80,000 tons annually (API Survey). The 308 Survey reported capacity expansion for the unbleached Kraft paper product sector is thus slightly lower than capacity expansion reported by API.

Age and Productivity

The age structure in the unbleached Kraft product sector was in somewhat of a decline in the late 1970s after a revitalization in the 1960s. Productivity growth in this product sector was high (3 to 4 percent per year) in the 1960s and low (1 to 2 percent per year) in the 1970s. The degree of technological obsolescence in this product sector is low (DRI estimates). Capital investment during the past five years by mills producing in this product sector totals $1,512,810,000. Investment per unit capacity equals $36,000, which is moderately low compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the unbleached Kraft product sector employed roughly 12,100 people in 1978. This represented approximately 4.8 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimate based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Bleached Kraft paper is defined in this report as paper used for wrapping paper (e.g., delicatessen paper, butcher paper), shipping sack, bag and sack other than shipping sack, and for other converting papers which contain more than 50 percent bleached Kraft wood pulp.

Firms in Product Sector

There are 30 U.S. firms that produce bleached Kraft paper. The major producers are:

Crown Zellerbach Corp.
International Paper Co.
Longview Fibre Co.
St. Regis Paper Co.
Scott Paper Co.
Union Camp Corp.
James River Corp.
Menominee Paper Co., Inc.

Source: Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 64.2 percent, and the top eight firms' capacity share was 78.0 percent. This is thus a concentrated product sector. (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.)

Total Capacity and Utilization Rate

U.S. capacity to produce bleached Kraft paper is 3,511* tons per day, or 1.74 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). The 1979 estimated capacity utilization rate for packaging paper other than unbleached Kraft (including bleached Kraft papers) was 82.5 percent (Paper Trade Journal, June 30, 1979, estimate).

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*Five mills in this product sector did not report capacity data and were not included in this total.

Vertical Integration

Most of the firms in this product sector are vertically integrated (DRI estimates). Vertically integrated here means integrated from raw materials (wood, wastepaper, etc.) to converted product. Twenty-one mills, or 51 percent of the mills in this product sector, include converting operations (308 Survey).

Horizontal Integration

The 17 largest firms are horizontally integrated to other economic production sectors, as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Crown Zellerbach Corp.	55%	Public
International Paper Co.	79%	Public
Longview Fibre Co.	83%	Public
St. Regis Paper Co.	82%	Public
Scott Paper Co.	92%	Public
Union Camp Corp.	89%	Public
James River Corp.	29%	Public
Menominee Paper Co., Inc.	--	--
Georgia-Pacific Corp.	20%	Public
Boise Cascade Corp.	53%	Public
Hammermill Paper Co.	93%	Public
Weyerhaeuser Co.	43%	Public
Brown Co.	78%	Public
Equitable Bag Co., Inc.	--	--
Fraser Paper Ltd.	80%	Public
Merrimac Paper Co.	--	--
Shawano Paper Mills, Inc.	--	--

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

The chief competition for packaging material for bleached Kraft paper is high-density polyethylene bags which penetrated the bleached bag market heavily in the 1970s and have captured new markets as they have opened up. Plastic bags and wraps are competitively priced and have many superior user characteristics with respect to bleached bag, sack, and wrap. Among the most important plastics' inroads into the bleached Kraft paper market have been the switch by many supermarkets to low-density polyethylene films for packaging and the increased use by farm fertilizer producers of plastic sacks

rather than 50-pound bleached Kraft shipping sacks. Many retail merchandise stores have also switched to plastic bags due to:

- o higher consumer appeal;
- o tear resistancy with associated light weight;
- o good printability;
- o multicolor characteristics;
- o acceptability of small orders so small stores can have their own printed bags; and
- o easy storage due to light weight and compactness.

The only bright spot in the bleached bag market has been the fast-food industry. Usage in this sector increased rapidly in the 1970s, but the upswing in this market has been overwhelmed by the loss of share in other bleached bag markets (DRI, Pulp and Paper Review, December 1977, p. 57).

Mills

Number of Mills

The 30 firms in this product sector control 40 mills which produce bleached Kraft paper. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*	Fine Bleached Kraft & Soda
*	*	Unbleached Kraft (Bag)
17	42%	Misc. Integrated Mills
*	*	Deink (Tissue)
*	*	Tissue from Wastepaper
*	*	Paperboard from Wastepaper
*	*	Misc. Secondary Fiber Mills
*	*	Nonintegrated Fine Papers
*	*	Nonintegrated Tissue Papers
*	*	Nonintegrated Lightweight
*	*	Nonintegrated Paperboard
6	15%	Misc. Nonintegrated Mills
40	100%	

Source: 308 Survey.

Size

The average mill capacity is 653 tons per day, with a standard deviation of 601, and the median capacity is 420 tons per day (308 Survey).

Location

Bleached Kraft paper producing mills are located throughout the United States, with a regional breakdown as follows:

Region	Number of Mills
Northeast	10 (24%)
Southeast	12 (29%)
North Central	11 (27%)
Northwest	* (*%)
West and Southwest	* (*%)
	40

Source: 308 Survey.

Indirect Dischargers

Nine mills, or 29 percent of the mills in the bleached Kraft product sector, are indirect dischargers. The percents of mills in each region which are indirect dischargers are as follows:

Region	% of Mills
Northeast	*%
Southeast	0%
North Central	*%
Northwest	*%
West and Southwest	*%

Source: 308 Survey.

Planned Capacity Expansion

Planned daily capacity expansion in the bleached Kraft product sector is expected to be 465 short tons per day. This represents a reduction of capacity in one mill, an expansion of capacity in five mills, and one mill with new capacity coming on-stream. This expansion will be an increase of 13.3 percent in the capacity to produce bleached Kraft paper by all mills.

A capital investment of $119,847,000 is planned for this expansion. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure. (308 Survey)

Assuming 350 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion reported in response to the 308 Survey equals 163,000 tons annually. Capacity expansion as reported in the API Survey from 1978 to 1982 is 38,000 tons annually (API Survey). The 308 Survey reported capacity expansion for the bleached Kraft paper product sector is thus higher than capacity expansion reported by API.

Age and Productivity

The age structure in the bleached Kraft product sector is generally older than in the unbleached sector which reached its height in the 1960s. There have been no new mills or machines added recently. Productivity growth in this product sector has been lower than unbleached Kraft papers. The degree of technological obsolescence in this product sector is relatively high (DRI estimates). Capital investment during the past five years by mills producing in this product sector totals $1,214,639,000. Investment per unit capacity equals $45,000, which is moderate compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the bleached Kraft product sector employed roughly 5,700 people in 1978. This represented approximately 2.3 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Glassine and greaseproof paper is defined in this report as paper used for industrial converting, including glassine, greaseproof, and vegetable parchment, and some bleached and unbleached sulfite packaging papers.

Firms in Product Sector

There are eight U.S. firms that produce glassine and greaseproof paper. The major producers are:

St. Regis Paper Co.
Philip Morris Industries Paper Group
Deerfield Specialty Papers, Inc.
James River Corp.
Crown Zellerbach Corp.
Mosinee Paper Corp.
Westfield River Paper Co., Inc.
Weyerhaeuser Co.

Source: Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 80.5 percent, and the top eight firms' capacity share was 100 percent. This is thus a highly concentrated product sector. (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates).

Total Capacity and Utilization Rate

U.S. capacity to produce glassine and greaseproof paper is 656* tons per day, or 0.32 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). The estimated 1979 capacity utilization rate for packaging paper other than unbleached Kraft (including glassine and greaseproof paper) was 82.5 percent (Paper Trade Journal, June 30, 1979, estimate).

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*One mill in this product sector did not report capacity data and was not included in this total.

Vertical Integration

About half the firms in this product sector are vertically integrated (DRI estimates). Vertically integrated here means integrated from raw materials (wood, wastepaper, etc.) to converted product. Six mills, or 60 percent of the mills in this product sector, include converting operations (308 Survey).

Horizontal Integration

The eight largest firms are horizontally integrated to other economic production sectors, as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
St. Regis Paper Co.	82%	Public
Philip Morris Industries Paper Group	5%	Public
Deerfield Specialty Papers, Inc.	--	--
James River Corp.	29%	Public
Crown Zellerbach Corp.	55%	Public
Mosinee Paper Corp.	--	--
Westfield River Paper Co., Inc.	--	--
Weyerhaeuser Co.	43%	Public

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Economic trends and technology changes have affected glassine and greaseproof paper in much the same way as bleached Kraft papers. The major recent trend has been severe competition from plastics. In general, higher quality glassine and greaseproof packaging materials have held out against inroads by plastics, while lower grades have not. (Discussions with DRI Pulp and Paper Service staff, August 2, 1979).

Mills

Number of Mills

The eight firms in this product sector control ten mills which produce glassine and greaseproof paper. These are listed below by production sub-category:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*	Papergrade Sulfite
*	*	Misc. Integrated Mills
*	*	Nonintegrated Fine Papers
*	*	Misc. Nonintegrated Mills
10	100%	

Source: 308 Survey.

Size

The average mill capacity is 224 tons per day, with a standard deviation of 314, and the median capacity is 105 tons per day (308 Survey).

Location

Glassine and greaseproof producing mills are located throughout the United States except in the West and Southwest, with a regional breakdown as follows:

Region	Number of Mills
Northeast	5 (50%)
Southeast	* (*%)
North Central	* (*%)
Northwest	* (*%)
West and Southwest	0 (0%)

Source: 308 Survey.

Indirect Dischargers

One mill or ten percent of the mills in the glassine and greaseproof product sector are indirect dischargers. For reasons of confidentiality, no location data are provided (308 Survey).

Planned Capacity Expansion

Planned daily capacity expansion in the glassine and greaseproof product sector is expected to be five short tons per day. This represents an expansion of capacity in two mills. This expansion will be an increase of 0.8 percent in the capacity to produce glassine and greaseproof by all mills. A capital investment of $415,000 is planned for this expansion.

These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure. (308 Survey) American Paper Institute capacity expansion data are unavailable for the glassine and greaseproof product sector and therefore no comparison is possible.

Age and Productivity

The age structure in the glassine and greaseproof sector is old. There have recently been no new mills or machines added. Productivity growth in this product sector is low (1 to 2 percent per year), and the degree of technological obsolescence is high. (Discussions with DRI Pulp and Paper Service staff, August 2, 1979). Capital investment during the past five years by mills producing in this product sector totals $221,804,000. Investment per unit capacity equals $99,000, which is very high compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the glassine product sector employed roughly 1,600 people in 1978. This represented approximately 0.6 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Tissue in this report includes sanitary grades (i.e., toilet, facial, napkin, toweling, sanitary napkin, diaper, wiper, and special sanitary papers) for brand name sale (or produced for store brands) in supermarkets, drugstores, etc., and sanitary grades for industrial use and waxing, wrapping, wadding, and miscellaneous grades.

Firms in Product Sector

There are 42 U.S. firms that produce tissue. The major producers are:

Scott Paper Co.
The Proctor & Gamble Co.
Kimberly-Clark Corp.
American Can Co.
Crown Zellerbach Corp.
Fort Howard Paper Co.
Georgia-Pacific Corp.
Brown Co.

Source: Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 65.5 percent and the top eight firms' capacity share was 80.1 percent. This is thus a concentrated product sector (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates).

Total Capacity and Utilization Rate

U.S. capacity to produce tissue is 12,792 tons per day, or 6.33 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). In 1979, U.S. firms' capacity utilization rate was 88.3 percent (Pulp and Paper, April 1979 estimate). (This may be low due to effects of several West Coast mill strikes in 1978 and 1979.)

Vertical Integration

Most of the firms in this sector are vertically integrated (ADL, 1977 and DRI estimates). Vertically integrated here means integrated from raw materials (wood, wastepaper, etc.) to converted product. Fifty-eight mills

or 64 percent of the mills in this product sector include converting operations (308 Survey).

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Scott Paper Co.	92%	Public
The Proctor & Gamble Co.	15%	Public
Kimberly-Clark Corp.	92%	Public
American Can Co.	9%	Public
Crown Zellerbach Corp.	55%	Public
Fort Howard Paper Co.	100%	Public
Georgia-Pacific Corp.	20%	Public
Brown Co.	78%	Public
Hudson Pulp & Paper Corp.	90%	Public
Diamond International Corp.	54%	Public
Erving Paper Mills	64%	Public
Marcal Paper Mills, Inc.	--	--
Potlatch Corp.	64%	Public
Nitec Paper Corp.	--	Private
Statler Tissue Co.	--	Private

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

In the 1950s and 1960s, consumer tissue displaced reusable fabrics in the napkin and towel product categories. By roughly 1968 this displacement was completed. Future demand for tissue products will relate closely to factors such as consumer disposable income and household growth (since tissue displacement of reusable fabrics has subsided). Consumer tissue is, and is expected to continue to be, more recession-proof and less subject to cyclical swings in consumption levels than the pulp and paper industry, or the economy as a whole. Many consumer tissue producers rely heavily on non-price incentives to market their products, in contrast to the majority of paper and paperboard products producers whose sales of commodities are almost entirely based upon price considerations.

The only economical substitute for consumer tissue is a return to reusable cloth fabrics. A new process to produce fluffier tissue using

less pulp has very recently been developed (discussions with DRI Pulp and Paper Service staff; ADL, 1977; Kline Guide).

Industrial tissue products may contain a large amount of recycled material in addition to, or as a substitute for, virgin wood pulp. Much of it is therefore produced in non-integrated secondary fiber mills. Industrial tissue demand closely follows employment patterns and consumption is based almost solely on price (rather than on non-price characteristics as in the consumer tissue sector). Demand for industrial tissue is less recession-proof than demand for consumer tissue, and fluctuates as employment and GNP fluctuate. It is likely that future industrial tissue production will shift toward large vertically integrated producers and away from the urban based smaller non-integrated producers. Though the integrated producers use more virgin fiber in their furnish, which is more costly than waste fiber, the economies of scale associated with large operations, the present relatively low cost of company-owned wood, and the ability to offer consumers higher quality products will create difficulties for the marginal, non-integrated producers. In addition, it is possible that increases in industrial tissue prices may cause some consumers to economize on consumption (discussions with DRI Pulp and Paper Service staff; DRI, Pulp and Paper Review, August 1979, pp. 67-68; ADL, 1977; Kline Guide).

Mills

Number of Mills

The 42 firms in this product sector control 89 mills which produce tissue paper. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*%	Market Bleached Kraft
*	*%	BCT Bleached Kraft
*	*%	Fine Bleached Kraft and Soda
*	*%	Semi-Chemical
6	7%	Papergrade Sulfite
*	*%	Unbleached Kraft (Bag)
10	11%	Misc. Integrated Mills
12	13%	Deink (Tissue)
17	19%	Tissue from Wastepaper
*	*%	Paperboard from Wastepaper
5	6%	Misc. Secondary Fiber Mills
*	*%	Nonintegrated Fine Papers
25	28%	Nonintegrated Tissue Papers

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*%	Nonintegrated Lightweight
*	*%	Misc. Nonintegrated Mills
89	100%	

Source: 308 Survey.

Size

The average mill capacity is 285 tons per day, with a standard deviation of 353, and the median capacity is 137 tons per day (308 Survey).

Location

Tissue producing mills are located mainly in the northeast and north central sections of the United States, with a regional breakdown as follows:

Region	Number of Mills
Northeast	38 (43%)
Southeast	12 (13%)
North Central	22 (23%)
Northwest	8 (9%)
West and Southwest	9 (10%)
	89

Source: 308 Survey.

Indirect Dischargers

Twenty-seven or 30 percent of the mills in the tissue product sector are indirect dischargers. The percents of mills in each region which are indirect dischargers are as follows:

Region	% of Mills
Northeast	32
Southeast	*
North Central	27
Northwest	0
West and Southwest	78

Source: 308 Survey.

Planned Capacity Expansion

Planned daily capacity expansion in the tissue product sector is expected to be 1,141 short tons per day. This represents an expansion of capacity in 13 mills. This expansion will be an increase of 8.9 percent in the capacity to produce tissue by all mills. A capital investment of $377,552,000 is planned for this expansion. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure. (308 Survey)

Assuming 352 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion reported in response to the 308 Survey equals 402,000 tons annually. Capacity expansion as reported in the API Survey from 1978 to 1982 is 751,000 tons annually (API Survey). The 308 Survey reported capacity expansion for the tissue product sector is thus lower than capacity expansion reported by API.

Age and Productivity

The age structure of consumer tissue mills is fairly young; there have recently been many new mills and machines added. The age structure of the tissue mills is old but becoming younger as large integrated companies move in; there have been several new mills and several new machines added in the 1970s. Productivity growth in this product sector is high (3 to 4 percent per year). Consumer tissue mills' technologies are modern, since this is a prime basis of competition among producers. The degree of technological obsolescence in industrial tissue mills is high; however, many old, inefficient mills are being replaced (discussions with DRI Pulp and Paper Service staff, August 2, 1979). Capital investment during the past five years by mills producing in this product sector totals $1,270,515,000. Investment per unit capacity equals $43,000, which is moderately low compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the tissue product sector employed roughly 37,400 people in 1978. This represented approximately 15.0 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Special industrial paper in this report is defined as paper of all furnishes designed for specialized end uses, such as abrasive paper, absorbent paper, cable paper, electrical insulation, and similar grades.

Firms in Product Sector

There are 40 U.S. firms that produce special industrial paper. The major producers are:

James River Corp.
Hollingsworth & Vose Co.
The Proctor & Gamble Co.
Mosinee Paper Corp.
Knowlton Brothers
Boise Cascade Corp.
Prairie State Paper Mills,
  Div. of Chippewa Paper Prod. Co.
Filter Materials, Inc.

Source: Meta Systems estimates based on Lockwood's, DRI estimates and E. C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 43.5 percent and the top eight firms' capacity share was 52.3 percent. This is thus an unconcentrated product sector (Meta Systems estimates based on Lockwood's, DRI estimates, and E. C. Jordan estimates).

Total Capacity and Utilization Rate

U.S. capacity to produce special industrial paper is 2,209* tons per day or 1.09 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). Capacity utilization rate data are not available.

Vertical Integration

Few of the firms in this product sector are vertically integrated (DRI estimates). Vertically integrated here means integrated from raw materials (wood wastepaper, etc.) to converted product. Forty mills or 63 percent of the mills in this product sector include converting operations (308 Survey).

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*Two mills in this product sector did not report capacity data and were not included in this total.

Horizontal Integration

The 17 largest firms are horizontally integrated to other economic production sectors as indicated by the following earnings percentages:

Firm	Percent Earanings in Paper and Paperboard Sector	Publicly or Privately Owned
James River Corp.	29%	Public
Hollingsworth & Vose Co.	--	--
The Proctor & Gamble Co.	15%	Public
Mosinee Paper Corp.	--	--
Knowlton Brothers	--	--
Boise Cascade Corp.	53%	Public
Prairie State Paper Mills, Div. of Chippewa Paper Prod. Co.	--	--
Filter Materials, Inc.	--	--
Bemis Co., Inc.	48%	Public
Spaulding Fibre Co., Inc.	--	--
Texon, Inc.	--	--
Bird & Son, Inc.	--	--
Brown Co.	78%	Public
Chase Bag Co.	--	--
Mead Corp.	44%	Public
Sorg Paper Co.	--	--
Kimberly-Clark Corp.	92%	Public

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Though there are few direct substitute materials for special industrial paper, a number of the end products such as decorative laminates and luggage compete with substitute products made from other materials. Overall, demand for special industrial paper correlates well with the industrial production index, since special industrial paper has a wide variety of technical and industrial applications (ADL, 1977).

Mills

Number of Mills

The 40 firms in this product sector control 63 mills which produce special industrial paper. These are listed below by subcaterory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*	Fine Bleached Kraft & Soda
*	*	Papergrade Sulfite
*	*	Unbleached Kraft (Bag)
11	17%	Misc. Integrated Mills
*	*	Tissue from Wastepaper
*	*	Paperboard from Wastepaper
*	*	Misc. Secondary Fiber Mills
*	*	Nonintegrated Fine Papers
*	*	Nonintegrated Tissue Papers
14	22%	Nonintegrated Filter & Nonwoven
*	*	Nonintegrated Lightweight -- Electrical Allowance
*	*	Nonintegrated Paperboard
18	51%	Misc. Nonintegrated Mills
63	100%	

Source: 308 Survey

Size

The average mill capacity is 190 tons per day, with a standard deviation of 411, and the median capacity is 58 tons per day (308 Survey).

Location

The majority of special industrial paper producing mills are located in the Northeast, while others are distributed throughout the United States as follows:

Region	Number of Mills
Northeast	39 (62%)
Southeast	7 (11%)
North Central	13 (21%)
Northwest	* (*%)
West and Southwest	* (*%)
	63

Source: 308 Survey

Indirect Dischargers

Twenty-six mills or 41 percent of the mills in the special industrial product sector are indirect dischargers. The percent of mills in each region

which are indirect dischargers are as follows:

Region	% of Mills
Northeast	38
Southeast	*
North Central	54
Northeast	0
North Central	*

Source: 308 Survey

Planned Capacity Expansion

Planned daily capacity expansion in the special industrial product sector is expected to be 63 short tons per day. This represents an expansion of capacity in six mills. This expansion will be an increase of 2.9 percent in the capacity to produce special industrial paper by all mills. A capital investment of $26,841,000 is planned for this expansion. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure. (308 Survey)

Assuming 330 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion reported in response to the 308 Survey equals 21,000 tons annually. Capacity expansion as reported in the API Survey from 1978 to 1982 is 87,000 tons annually (API Survey). The 308 Survey reported capacity expansion for the special industrial product sector is thus lower than capacity expansion reported by API.

Age and Productivity

The age structure in the special industrial product sector is old, with no new mills or machines recently added. Productivity growth in this product sector is low (1 to 2 percent per year) and the degree of technological obsolescence is high. (Discussions with DRI Pulp and Paper Service staff, August 2, 1979). Capital investment during the past five years by mills producing in this product sector totals $593,611,000. Investment per unit capacity equals $40,000, which is moderatly low compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the special industrial product sector employed roughly 6,200 people in 1978. This represented approximately 2.5 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Newsprint is defined in this report as paper made largely from groundwood pulp, used chiefly in the printing of newspapers.

Firms in Product Sector

There are 16 U.S. firms that produce newsprint. The major producers are:

Bowater, Inc.
St. Regis Paper Co.
Kimberly-Clark Corp.
Garden State Paper Co., Inc.
Publishers Paper Co.
Nekoosa Papers, Inc.
Boise Cascade Corp.
International Paper Co.

Source: Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 60.2 percent, and the top eight firms' capacity share was 83.1 percent. This is thus a concentrated product sector (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates).

Total Capacity and Utilization Rate

U.S. capacity to produce newsprint is 11,691* tons per day, or 5.78 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). In 1979, U.S. firms' capacity utilization rate was estimated at 93.0 percent (Pulp and Paper, February 1979 estimate).

Vertical Integration

All of the firms in this sector are vertically integrated backward to raw materials (i.e., wood) (DRI estimate). Four mills, or 17 percent of the mills in this product sector, include converting operations (308 Survey).

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*Two mills in this product sector did not report capacity data and were not included in this total.

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors, as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Bowater, Inc.	44%	Public
St. Regis Paper Co.	82%	Public
Kimberly-Clark Corp.	92%	Public
Garden State Paper Co., Inc.	--	--
Publishers Paper Co.	8%	Public
Nekoosa Papers, Inc.	96%	Public
Boise Cascade Corp.	53%	Public
International Paper Co.	79%	Public
Crown Zellerbach Corp.	55%	Public
Abitibi Corp.	80%	Public
Southwest Forest Industries, Inc.	35%	Public
Georgia-Pacific Corp.	20%	Public
Manistique Pulp & Paper Co.	--	--
Hearst Corp.	--	--
Inland Empire Paper Co.	--	--

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Demand for newsprint depends on newspaper advertising, circulation, and commercial printing demand. Commercial printing is the largest non-newspaper use of newsprint. Newsprint quality for commercial printing is almost that of uncoated groundwood, the improvement in quality coming from technological innovations. All newsprint uses correlate closely to growth in GNP as well as measures of total consumer expenditures, new car expenditures, corporate profits, real disposable income, and number of households. Although newspaper advertising faces stiff competition from radio, TV advertising, and other printed media, its advertising costs are expected to remain competitive through 1981. Newspaper advertising costs will increase by roughly 9 percent per year, compared to 9 to 10 percent for magazines and 16 percent for network television. Several factors, including new printing technology, product development by newsprint producers, the low cost of newsprint relative to other printing grades, and newspaper advertising gains, have led to a recent large growth in U.S. demand for newsprint.

Scandinavia has consistently supplied 3 percent of U.S. newsprint demand through the mid-1970s. Canadian firms have supplied roughly 80 percent of

North American newsprint in the 1950s, 70 percent in the 1960s, and 61 to 65 percent in the 1970s, with U.S. firms producing almost all the rest. Causes for this recent decline include:

- rising Canadian production costs relative to their U.S. competitors;
- rapidly increasing newsprint capacity in the United States stimulated by this production costs trend; and
- expanding newsprint markets in the southern United States, where most of U.S. newsprint capacity is located, giving U.S. producers a large transportation advantage.

Source: DRI, Pulp and Paper Review, December 1977 and March 1979; ADL, 1977; Kline Guide.

Mills

Number of Mills

The 16 firms in this product sector control 24 mills which produce newsprint. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*	Groundwood--Thermo-Mechanical
*	*	Groundwood--Coarse, Molded, Newsprint
17	71%	Misc. Integrated Mills
*	*	Deink (Newsprint)
24	100%	

Source: 308 Survey.

Size

The average mill capacity is 961 tons per day, with a standard deviation of 549, and the median capacity is 836 tons per day (308 Survey).

Location

Newsprint producing mills are located throughout the United States, with a regional breakdown as follows:

Region	Number of Mills
Northeast	* (*%)
Southeast	7 (29%)
North Central	* (*%)
Northwest	7 (29%)
West and Southwest	* (*%)
	24

Source: 308 Survey.

Indirect Dischargers

Fewer than five of the mills in the newsprint product sector are indirect dischargers. Therefore, no regional breakdown can be given.

Planned Capacity Expansion

Planned daily capacity expansion in the newsprint product sector is expected to be 1,477 short tons per day. This represents an expansion of capacity in six mills. This expansion will be an increase of 12.6 percent in the capacity to produce newsprint by all mills. A capital investment of $239,488,000 is planned for this expansion. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure (308 Survey).

Assuming 357 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion reported in response to the 308 Survey equals 527,000 tons annually. Capacity expansion as reported in the API Survey from 1978 to 1982 is 1,329,000 tons annually (API Survey). The 308 Survey reported capacity expansion for the newsprint product sector is thus lower than capacity expansion reported by API.

Age and Productivity

The age structure in the newsprint product sector is very new, with over 50 percent of the mills built in the 1960s and 1970s. There have recently been several new mills and many new machines added. Productivity growth in this product sector is high (3 to 4 percent per year), and the degree of technological obsolescence is low. (Discussions with DRI Pulp and Paper Service staff, August 2, 1979). Capital investment during the past five years by mills producing in this product sector totals $879,557,000. Investment per unit capacity equals $38,000, which is moderately low compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the newsprint product sector employed roughly 10,500 people in 1978. This represented approximately 4.2 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Coated printing paper is defined in this report as bleached paper with a coating weight of at least two and one-half pounds on either side and at least 50 percent of the coating consisting of pigment. Among the specific products included in the coated printing paper sector are coated-one-side, coated-two-side Nos. 1-4, and coated-two-side No. 5.

Firms in Product Sector

There are 30 U.S. firms that produce coated printing paper. The major producers are:

Consolidated Papers, Inc.
Mead Corp.
International Paper Co.
Westvaco Corp.
Champion International
Crown Zellerbach Corp.
St. Regis Paper Co.
Blandin Paper Co.

Source: Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 40.5 percent, and the top eight firms' capacity share was 57.4 percent. This is thus an unconcentrated product sector. (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates).

Total Capacity and Utilization Rate

U.S. capacity to produce coated printing paper is 13,869 tons per day, or 6.86 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). The 1979 capacity utilization rate for U.S. firms producing coated groundwood publication papers was 95.4 percent, and the 1978 rate for No. 5 coated publication papers was 100 percent (Pulp and Paper, May 1979 estimate and May 1978).

Vertical Integration

Most of the firms in this product sector are vertically integrated (DRI estimate). Vertically integrated here means integrated from raw materials

(wood, wastepaper, etc.) to converted product. Twenty-seven mills, or 60 percent of the mills in this product sector, include converting operations (308 Survey).

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors, as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Consolidated Papers, Inc.	79%	Public
Mead Corp.	44%	Public
International Paper Co.	79%	Public
Westvaco Corp.	90%	Public
Champion International	47%	Public
Crown Zellerbach Corp.	55%	Public
St. Regis Paper Co.	82%	Public
Blandin Paper Co.	--	Private
Nekoosa Papers, Inc.	96%	Public
Boise Cascade Corp.	53%	Public
Scott Paper Co.	92%	Public
Niagra of Wisconsin Paper Corp.	--	--
Fraser Paper Ltd.	80%	Public
Potlatch Corp.	64%	Public
Bowater, Inc.	44%	Public

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Coated printing paper production can be divided roughly into 88 percent coated-two-side and 12 percent coated-one-side. Coated-one-side papers are almost entirely (85 percent) used for labels and wraps, especially in the processed food industry. Changes in packaging technology, cost, and consumer preferences threaten continued growth here due to:

- consumer acceptance of plastic wraps, labels, and bottles; and
- large increases in coated paper prices due to market tightness created by demand for coated-two-side papers, while plastic price increases have been very low over the same time period.

In general, the price of plastic substitutes relative to coated-one-side paper helps determine the degree of plastic's penetration into this market.

Coated-two-side Nos. 1-4 papers have grown recently due largely to consumer preference for high-quality media and advertising paper, the excellent printing qualities of Nos. 1-4, and the availability of extensive forest resources from which producers make the bleached chemical pulps used as the furnish for coated freesheet papers. Coated-two-side papers will benefit from the continuation of the current U.S. advertising boom, especially if cost differences between printed and electronics media increase.

There are three noteworthy long-term trends for coated-two-side Nos. 1-4. The first is a long-term trend toward use of lower basis weight paper in response to higher postal rates. The second is that when the economy is on a cyclical upswing, the proportion of high-quality papers (Nos. 1-4) increases. The third is that technology advancements improving the quality of uncoated groundwood may create future competition for coated-two-side Nos. 1-4.

Use of coated-two-side No. 5, while closely following magazine publishing activities in recent years, has not grown as much as other coated-two-sides, due in part to consumer preferences for the higher quality papers. However, expanded product diversification and lower unit prices, compared to coated freesheet grades, have made coated groundwood papers a more attractive commodity, especially in the commercial printing sectors. (ADL, 1977; DRI, Pulp and Paper Review, December 1977, March 1979, and August 1979; Pulp and Paper, May 1978 and May 1979).

Mills

Number of Mills

The 30 firms in this product sector control 45 mills which produce coated printing paper. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
13	29%	Fine Bleached Kraft & Soda
6	13%	Groundwood--Fine Papers
10	22%	Misc. Integrated Mills
*	*	Misc. Secondary Fiber Mills
8	18%	Nonintegrated Fine Papers
*	*	Nonintegrated Lightweight
*	*	Nonintegrated Paperboard
*	*	Misc. Nonintegrated Mills
45	100%	

Source: 308 Survey.

Size

The average mill capacity is 538 tons per day, with a standard deviation of 367, and the median capacity is 517 tons per day (308 Survey).

Location

Coated printing paper producing mills are located mainly in the northeast and north central parts of the United States, with a regional breakdown as follows:

Region	Number of Mills
Northeast	16 (36%)
Southeast	6 (13%)
North Central	20 (44%)
Northwest	* (*%)
West and Southwest	* (*%)
	45

Source: 308 Survey.

Indirect Dischargers

Eleven mills, or 24 percent of the mills in the coated printing paper product sector, are indirect dischargers. The percents of mills in each region which are indirect dischargers are as follows:

Region	% of Mills
Northeast	*
Southeast	*
North Central	25
Northwest	0
West and Southwest	*

Source: 308 Survey.

Planned Capacity Expansion

Planned daily capacity expansion in the coated printing product sector is expected to be 1,615 short tons per day. This represents an expansion of capacity in 16 mills. This expansion will be an increase of 11.6 percent in the capacity to produce coated printing by all mills. A capital investment of $343,346,000 is planned for this expansion. These data apply to

projects which were under construction in 1978 or budgeted and approved for expenditure. (308 Survey)

Assuming 356 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion reported in response to the 308 Survey equals 575,000 tons annually. Capacity expansion as reported in the API Survey from 1978 to 1982 is 965,000 tons annually (API Survey). The 308 Survey reported capacity expansion for the coated printing paper product sector is thus lower than capacity expansion reported by API.

Age and Productivity

The age structure in the coated printing paper product sector is moderate, but expansion is anticipated in the next three or four years. There have recently been a few new mills added, and a very large number of new machines is expected to be installed. Productivity growth in this product sector is moderately high, and the degree of technological obsolescence is moderate. (Discussions with DRI Pulp and Paper Service staff, August 2, 1979.) Capital investment during the past five years by mills producing in this product sector totals $1,518,975,000. Investment per unit capacity equals $63,000, which is moderately high for the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the coated printing product sector employed roughly 23,200 people in 1978. This represented approximately 9.3 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Uncoated freesheet paper in this report is defined as bleached uncoated printing and writing papers containing not more than 25 percent groundwood pulp in their furnish, such as offset, tablet, envelope, business (bond, ledger, mimeo, duplicator), form bond, cover and text, and book paper.

Firms in Product Sector

There are 53 U.S. firms that produce uncoated freesheet. The major producers are:

Champion International
International Paper Co.
Boise Cascade Corp.
Hammermill Paper Co.
Nekoosa Papers, Inc.
Union Camp Corp.
Mead Corp.
Weyerhaeuser Co.

Source: Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 40.1 percent, and the top eight firms' capacity share was 53.5 percent. This is thus an unconcentrated product sector. (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates).

Total Capacity and Utilization Rate

U.S. capacity to produce uncoated freesheet is 20,452* tons per day, or 10.12 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). The 1979 capacity utilization rate for U.S. firms producing uncoated printing and writing papers was 92.3 percent (Pulp and Paper, March 1979 estimate).

Vertical Integration

About 80 percent of the firms in this product sector are backward

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*Six mills in this product sector did not report capacity data and were not included in this total.

integrated to raw materials (DRI estimate). Paper is often sold in rolls to end users for final conversion. Smaller orders, sold as cut paper, tend to be converted at the paper mill site. Fifty-eight mills, or 56 percent of the mills in this product sector, include converting operations (308 Survey).

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors, as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Champion International	47%	Public
International Paper Co.	79%	Public
Boise Cascade Corp.	53%	Public
Hammermill Paper Co.	93%	Public
Nekoosa Papers, Inc.	96%	Public
Union Camp Corp.	89%	Public
Mead Corp.	44%	Public
Weyerhaeuser Co.	43%	Public
Allied Paper, Inc.	--	--
Potlatch Corp.	64%	Public
Georgia-Pacific Corp.	20%	Public
Westvaco Corp.	90%	Public
Finch, Pyrun & Co., Inc.	--	--
Scott Paper Co.	92%	Public
Crown Zellerbach Corp.	55%	Public

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Demand for uncoated freesheet papers has increased rapidly in the past 20 years. The underlying causes are as diverse as the markets which use uncoated freesheet. Among these causes are:

- o increases in demand for business forms, created largely by computers;
- o office automation and concomitant demand for copy, electric typewriter and duplicator papers, etc.;
- o increases in offset printing use and development of commercial printing as a major market; and

- o very low nominal price increases which offer an incentive to use these papers (the average price for uncoated book papers was actually lower, in nominal terms, in 1972 than in 1960).

This very competitive sector underwent significant capacity expansions in the 1960s. High operating rates, needed to offset large capital investment costs, and low variable cost increases combined in the 1960s and early 1970s to keep prices low. However, suppliers, hurt by excessive inventories in 1975, are now less prone to expand capacity, suggesting a future of infrequent large increments of capacity increase (following periods of very high capacity utilization).

Business demand for several types of uncoated freesheet -- business forms, computer stock, off-set paper for commercial printing and other converting, business papers, and book papers -- remains strong, as do future growth prospects. Cover and text papers probably will not grow due to consumer acceptance of lower priced, lower quality grades over this very high quality paper. Demand for Kraft envelopes will probably also remain roughly stable. (ADL, 1977; Kline Guide; DRI, Pulp and Paper Review, August 1979; discussions with DRI Pulp and Paper Service staff).

Mills

Number of Mills

The 53 firms in this product sector control 103 mills which produce uncoated freesheet. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
17	17%	Fine Bleached Kraft & Soda
*	*	Semi-Chemical
7	7%	Papergrade Sulfite
*	*	Groundwood--Coarse, Molded Newsprint
*	*	Groundwood--Fine Papers
20	19%	Misc. Integrated Mills
5	5%	Deink (Fine Papers)
5	5%	Misc. Secondary Fiber Mills
34	33%	Nonintegrated Fine Papers
*	*	Nonintegrated Lightweight
*	*	Nonintegrated Filter & Nonwoven
*	*	Nonintegrated Paperboard
8	8%	Misc. Nonintegrated Mills
103	100%	

Source: 308 Survey.

Size

The average mill capacity is 401 tons per day, with a standard deviation of 423; the median capacity is 271 tons per day (308 Survey).

Location

Uncoated freesheet producing mills are located generally in the northeast and north central regions of the United States, with a breakdown as follows:

Region	Number of Mills
Northeast	38 (37%)
Southeast	13 (13%)
North Central	40 (39%)
Northwest	* (*%)
West and Southwest	* (*%)
	103

Source: 308 Survey.

Indirect Dischargers

Thirty-four mills, or 33 percent of the mills in the uncoated freesheet product sector, are indirect dischargers. The percents of mills in each region which are indirect dischargers are as follows:

Region	% of Mills
Northeast	39
Southeast	*
North Central	35
Northwest	*
West and Southwest	*

Source: 308 Survey.

Planned Capacity Expansion

Planned daily capacity expansion in the uncoated freesheet product sector is expected to be 1,247 short tons per day. This represents a reduction of capacity in two mills and an expansion of capacity in 17 mills. This expansion will be an increase of 6.1 percent in capacity to produce uncoated freesheet by all mills. A capital investment of $190,579,000 is planned for

this expansion. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure. (308 Survey)

Assuming 352 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion reported in response to the 308 Survey equals 439,000 tons annually. Capacity expansion as reported in the API Survey from 1978 to 1982 is 1,004,000 tons annually (API Survey). The 308 Survey reported capacity expansion for the uncoated freesheet paper product sector is thus lower than capacity expansion reported by API.

Age and Productivity

The age structure in the uncoated freesheet product sector is mixed. Mills producing uncoated book, excluding offset, and cover and text papers are generally old, while those producing offset papers and chemical wood pulp papers are typically young. Only a few mills, but a fairly high number of new machines, have been recently added in the sector. Productivity growth in this product sector has been very high, especially in the 1960s, and the degree of technological obsolescence is high only in those grades with an old age structure. (Discussions with DRI Pulp and Paper Service staff, August 2, 1979). Capital investment during the past five years by mills producing in this product sector totals $2,766,964,000. Investment per unit capacity equals $54,000, which is moderate compared to the industry as a whole. (308 Survey). (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the uncoated freesheet product sector employed roughly 36,600 people in 1978. This represented approximately 14.6 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Uncoated groundwood paper in this report is defined as uncoated papers, such as groundwood printing papers containing more than 25 percent groundwood fiber in their furnish, excluding newsprint.

Firms in Product Sector

There are 17 U.S. firms that produce uncoated groundwood. The major producers are:

Nekoosa Papers, Inc.
St. Regis Paper Co.
Weyerhaeuser Co.
Crown Zellerbach Corp.
Boise Cascade Corp.
Fraser Paper Ltd.
Georgia-Pacific Corp.
Blandin Paper Co.

Source: Meta Systems estimates based on Lockwood's, DRI estimates and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 67.2 percent and the top eight firms' capacity share was 84.5 percent. This is thus a concentrated product sector. (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates).

Total Capacity and Utilization Rate

U.S. capacity to produce uncoated groundwood paper is 3,572 tons per day, or 1.77 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). This represents roughly 49 percent of total 1979 North American uncoated groundwood paper production. In 1979, U.S. firms' capacity utilization rate was 104.8 percent (Pulp and Paper, October 1979 estimates).

Vertical Integration

About 90 percent of the firms in this sector are backward integrated to raw materials (DRI estimate). Ten mills or 45 percent of the mills in this product sector include converting operations (308 Survey).

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Nekoosa Papers, Inc.	96%	Public
St. Regis Paper Co.	82%	Public
Weyerhaeuser Co.	43%	Public
Crown Zellerbach Corp.	55%	Public
Boise Cascade Corp.	53%	Public
Fraser Paper Ltd.	80%	Public
Georgia-Pacific Corp.	20%	Public
Blandin Paper Co.	--	Private
Appleton Papers Div. of NCR	--	--
Bowater, Inc.	44%	Public
Midtec Paper Corp.	--	--
Hennepin Paper Co.	--	--
Hearst Corp.	--	--
Inland Empire Paper Co.	--	--
Manistique Pulp & Paper Co.	--	--

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Uncoated groundwood paper producers lost market share in their major market, the printing and publishing industry, between 1960 and 1975. Since 1976, however, this trend has completely reversed, and uncoated groundwood has begun regaining market share. Reasons for this trend include:

- the printed media advertising boom has increased consumer acceptance of, and consequent demand for, printing on uncoated groundwood papers;
- technology improvements, such as the introduction of super calendered uncoated groundwood production have created higher quality grades whose printing charactertistics allow them to compete with freesheet grades;
- new printing technologies, more compatible with groundwood sheets, have helped increase consumer acceptance of uncoated groundwood;

- there is a significant price differential between uncoated groundwood grades and competitors; and

- there has been a shift from newsprint to higher quality uncoated groundwood papers for advertising inserts in newspapers.

The trends toward greater market share and new market penetration by the uncoated groundwood paper product sector should continue in the near future. (DRI, Pulp and Paper Review, December 1977, pp. 15-16, and August 1979, pp. 17-18; discussions with DRI Pulp and Paper Service staff; Kline Guide, p. 76).

Mills

Number of Mills

The 17 firms in this product sector control 22 mills which produce uncoated groundwood paper. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*%	Fine Bleached Kraft & Soda
*	*%	Groundwood -- Thermo-Mechanical
*	*%	Groundwood -- Coarse, Molded Newsprint
*	*%	Groundwood -- Fine Papers
8	36%	Misc. Integrated Mills
*	*%	Deink (Fine Papers)
*	*%	Misc. Secondary Fiber Mills
*	*%	Nonintegrated Fine Papers
22	100%	

Source: 308 Survey.

Size

The average mill capacity is 602 tons per day, with a standard deviation of 508; the median capacity is 468 tons per day (308 Survey).

Location

Uncoated groundwood paper producing mills are located mainly in the northeast and north central regions of the United States, with a breakdown as follows:

Region	Number of Mills
Northeast	8 (36%)
Southeast	* (*%)
North Central	8 (36%)
Northwest	* (*%)
West and Southwest	* (*%)
	22

Source: 308 Survey.

Indirect Dischargers

Fewer than five of the mills in the uncoated groundwood product sector are indirect dischargers. Therefore, no regional breakdown is given.

Planned Capacity Expansion

Planned daily capacity reduction in the uncoated groundwood product sector is expected to be 62 short tons per day. This represents a reduction of capacity in 2 mills and an expansion of capacity in 3 mills. This reduction will be a decrease of 1.7 percent in the capacity to produce uncoated groundwood by all mills. A capital investment of $20,294,000 is planned for the expansions included in this capacity change. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure. (308 Survey)

Assuming 357 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity reduction reported in response to the 308 Survey equals 300 tons annually. Capacity expansion as reported in the API Survey from 1978 to 1982 is 102,000 tons annually (API Survey). The 308 Survey reported capacity expansion for the uncoated groundwood paper product sector is thus lower than capacity expansion reported by API.

Age and Productivity

The age structure in the uncoated groundwood product sector is average, not old or new. There have recently been very few new mills and only a few new machines added. Productivity growth in this product sector is not very high and compared to Canadian mills, the degree of technological obsolescence is probably higher. (Discussions with DRI Pulp and Paper Service staff, August 2, 1979). Capital investment during the past five years by mills producing in this product sector totals $740,689,000. Investment per unit capacity equals $45,000, which is moderate compared to the industry as a whole. (308 Survey) (Note: High capital investment does

not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the uncoated groundwood product sector employed roughly 4,300 people in 1978. This represented approximately 1.7 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Thin papers in this report are defined as thin specialties paper including tracing, onionskin, carbonizing, cigarette, Bible, and other similar papers.

Firms in Product Sector

There are 18 U.S. firms that product thin papers. The major producers are:

Olin Corp.
Kimberly-Clark Corp.
International Paper Co.
Dunn Paper, Div. of Dennison Mfg. Co.
Hammermill Paper Co.
Port Huron Paper Co.
James River Corp.
Burrows Paper Corp.

Source: Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 60.0 percent and the top eight firms' capacity share was 77.7 percent. This is thus a concentrated product sector. (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates).

Total Capacity and Utilization Rate

U.S. capacity to product thin papers is 1,716 tons per day, or 0.85 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). In 1978, U.S. firms' capacity utilization rate was 89 percent (DRI, Pulp and Paper Review, March 1979, p. 15).

Vertical Integration

Most of the firms in this product sector are vertically integrated. (DRI estimate) Vertically integrated here means integrated from raw materials (wood, wastepaper, etc.). Ten mills or 48 percent of the mills in this product sector include converting operations. (308 Survey)

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Olin Corp.	--	--
Kimberly-Clark Corp.	92%	Public
International Paper Co.	79%	Public
Dunn Paper, Co., Div. of Dennison Mfg. Co.	--	--
Hammermill Paper Co.	93%	Public
Port Huron Paper Co.	--	--
James River Corp.	29%	Public
Burrows Paper Corp.	--	--
The Dexter Corp.	--	--
Potlatch Corp.	--	--
Bergstrom Paper Co.	--	--
Minnesota Mining and Mfg. Co., Paper Printing Products Div.	--	--
Seaman Paper Co. of Mass., Inc.	--	--
Sorg Paper Co.	--	--
Weyerhaeuser Co.	43%	Public

Source: Paper Trade Journal, June 30, 1979, pp. 44-47

Economic and Technological Trends

Thin papers are used economy-wide, with growth cycles reflecting GNP changes. One-time carbonizing paper, a high-growth sector in the early 1970's has slowed its growth rate since 1974. This was caused largely by consumer acceptance of carbonless papers. However, anticipated short-term relative price increases for carbonless papers (through 1981) compared to those for one-time carbonizing papers, should stimulate a rise in market share of the latter during the next two years. Other thin papers (Bible, cigarette, etc.) have exhibited somewhat the same growth behavior relative to the overall economy. Lower prices have helped these grades increase their market share since 1977, though the rate of increase will slow through 1980. (DRI, Pulp and and Paper Review, March 1979, p. 15.)

Mills

Number of Mills

The 18 firms in this product sector control 21 mills which produce thin papers. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*	Fine Bleached Kraft Soda
*	*	Groundwood -- Fine Papers
*	*	Unbleached Kraft (Bag)
*	*	Misc. Integrated Mills
*	*	Tissue from Wastepaper
*	*	Misc. Secondary Fiber Mills
*	*	Nonintegrated Fine Papers
9	43%	Nonintegrated Lightweight
*	*	Nonintegrated Lightweight -- Electrical Allowance
*	*	Misc. Nonintegrated Mills
21	100%	

Source: 308 Survey

Size

The average mill capacity is 272 tons per day, with a standard deviation of 366; the median capacity is 96 tons per day (308 Survey).

Location

Thin papers producing mills are located mainly in the northeast and north central regions of the United States, with a breakdown as follows:

Region	Number of Mills
Northeast	9 (43%)
Southeast	* (*%)
North Central	7 (33%)
Northwest	* (*%)
West and Southwest	* (*%)
	21

Source: 308 Survey

Indirect Dischargers

Five mills or 24 percent of the mills in the thin papers product sector are indirect dischargers. The percents of mills in each region which are indirect dischargers are as follows:

Region	% of Mills
Northeast	*
Southeast	0
North Central	*
Northwest	*
West and Southwest	*

Source: 308 Survey

Planned Capacity Expansion

Planned daily capacity expansion in the thin papers product sector is expected to be 19 short tons per day. This represents an expansion of capacity in three mills. This expansion will be an increase of 1.1 percent in the capacity to produce thin papers by all mills. A capital investment of $4,831,000 is planned for this expansion. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditures. (308 Survey)

Assuming 338 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion reported in response to the 308 Survey equals 6,000 tons annually. Capacity reduction as reported in the API Survey from 1978 to 1982 is 27,000 tons annually. (API Survey) The 308 Survey reported capacity expansion for the thin papers product sector is thus higher than future capacity as reported by API.

Age and Productivity

The age structure in the thin papers product sector is old. There have been no new mills and no new machines recently added, creating a high degree of technological obsolescence. Productivity growth in this product sector is low (1 to 2 percent per year). (Discussions with DRI Pulp and Paper Service staff, August 2, 1979). Capital investment during the past five years by mills producing in this product sector totals $540,093,000. Investment per unit capacity equals $95,000, which is very high compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production).

Employment

Meta Systems estimates that the thin papers product sector employed roughly 2,900 people in 1978. This represented approximately 1.1 percent of total pulp, papar, and paperboard mill employment. (Meta Systems estimate based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Solid bleached bristols in this report are defined as solid bleached paper produced for such products as tabulating index, tag, file folder, coated cover bristols, and uncoated bristols (e.g., index, printing, and postcard).

Firms in Product Sector

There are 18 U.S. firms that produce solid bleached bristols. The major producers are:

Scott Paper Co.
International Paper Co.
Federal Paper Board Co., Inc.
Union Camp Corp.
Potlatch Corp.
Watervliet Paper Co., Inc.
Bird & Son, Inc.
Diamond International Corp.
Wausau Paper Mills Co.

Source: Meta Systems estimates based on Lockwood's, DRI estimates and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 69.3 percent and the top eight firms' capacity share was 81.0 percent. This is thus a concentrated product sector. (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates).

Total Capacity and Utilization Rate

U.S. capacity to produce solid bleached bristols is 2,726* tons per day, or 1.35 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). In 1978, U.S. firms' capacity utilization rate was 89 percent (DRI, Pulp and Paper Review, March 1979, p. 14).

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*One mill in this product sector did not report capacity data and was not included in this total.

Vertical Integration

Most of the firms in this product sector are vertically integrated (DRI estimates). Vertically integrated here means integrated from raw materials (wood, wastepaper, etc.) to converted product. Eleven mills, or 50 percent of the mills in this product sector include converting operations (308 Survey).

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Scott Paper Co.	92%	Public
International Paper Co.	79%	Public
Federal Paper Board Co., Inc.	98%	Public
Union Camp Corp.	89%	Public
Potlatch Corp.	64%	Public
Watervliet Paper Co., Inc.	--	--
Bird & Son, Inc.	--	--
Diamond International Corp.	54%	Public
Wausau Paper Mills Co.	--	--
Sorg Paper Co.	--	--
Boise Cascade Corp.	53%	Public
James River Corp.	29%	Public
Philip Morris Ind. Paper Group	5%	Public
Weyerhaeuser Co.	43%	Public
Hammermill Paper Co.	93%	Public

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Demand has been essentially static since 1969 primarily because of declining use of tabulating cards as business machines are designed for greater use of tape input/output and larger internal memory banks and with the increasing use of interactive computer systems. The continuation of these trends will lead to declining demand. Demand for other grades, such as tag and file folder, correlates well with GNP. However, the introduction of electronic devices into the office will tend to damper growth in this sector. (ADL, 1977, p. 63; discussions with DRI Pulp and Paper Service staff; DRI, Pulp and Paper Review, August 1979, pp. 18-19).

Mills

Number of Mills

The 18 firms in this product sector control 22 mills which produce solid bleached bristols. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*%	BCT Bleached Kraft
*	*%	Fine Bleached Kraft & Soda
*	*%	Semi-Chemical
*	*%	Papergrade Sulfite
6	27%	Misc. Integrated Mills
*	*%	Misc. Secondary Fiber Mills
*	*%	Nonintegrated Fine Papers
*	*	Misc. Nonintegrated Mills
22	100%	

Source: 308 Survey.

Size

The average mill capacity is 743 tons per day, with a standard deviation of 601; the median capacity is 553 tons per day (308 Survey).

Location

Solid bleached bristols producing mills are located throughout the United States, with a regional breakdown as follows:

Region	Number of Mills
Northeast	6 (27%)
Southeast	7 (32%)
North Central	5 (23%)
Northwest	* (*%)
West and Southwest	* (*%)
	22

Source: 308 Survey.

Indirect Dischargers

Seven mills or 32 percent of the mills in the solid bleached bristols product sector are indirect dischargers. The percents of mills in each region which are indirect dischargers are as follows:

Region	% of Mills
Northeast	*
Southeast	0
North Central	*
Northwest	*
West and Southwest	Confidential

Source: 308 Survey.

Planned Capacity Expansion

Capacity expansion is planned for only one mill in the solid bleached bristols product sector. (308 Survey) For confidentiality reasons these data are not provided. Capacity reduction as reported in the API Survey from 1978 to 1982 is 213,000 tons annually (API Survey). Thus, the 308 Survey reported capacity expansion for the solid bleached bristols product sector cannot be compared to future capacity as reported by API.

Age and Productivity

The age structure in the solid bleached bristols product sector is old, since many machines have been shut down without replacements. Any new machines which might be installed are expected to be located in the South. Productivity growth in this product sector is low (1 to 2 percent per year) and the degree of technological obsolescence is moderate. (Discussions with DRI Pulp and Paper Service staff, August 2, 1979). Capital investment during the past five years by mills producing in this produce sector totals $899,581,000. Investment per unit capacity equals $55,000, which is moderately high compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the solid bleached bristols product sector employed roughly 4,000 people in 1978. This represented approximately 1.6 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimate based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Cotton fibre paper is defined in this report as papers containing 25 percent or more in their furnish of cotton, cotton rags, cotton waste, linters, linter pulp, flax, or similar fibers.

Firms in Product Sector

There are 19 U.S. firms that produce cotton fibre paper. The major producers are:

Crane & Co.
Hammermill Paper Co.
Mead Corp.
Spaulding Fibre Co.
Consolidated Papers Inc.
Continental Fibre Co.
Kimberly-Clark Corp.
Nekoosa Paper Co.
Rising Paper Co.
Simpson Paper Co.

Source: Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 45.2 percent, and the top eight firms' capacity share was 61.2 percent. This is thus a moderately concentrated product sector. (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.)

Total Capacity and Utilization Rate

U.S. capacity to produce cotton fibre paper is 552* tons per day, or 0.27 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). In 1979, U.S. firms' capacity utilization rate was 83 percent (DRI, Pulp and Paper Review, March 1979, p. 16).

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*One mill in this product sector did not report capacity data and was not included in this total.

Vertical Integration

Few of the firms in this sector are backward integrated to wood, although all are integrated to cotton fibre (DRI estimates). Seventeen mills, or 74 percent of the mills in this product sector, are forward integrated and include converting operations (308 Survey).

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors, as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Crane & Co.	--	--
Hammermill Paper Co.	93%	Public
Mead Corp.	44%	Public
Spaulding Fibre Co.	--	--
Consolidated Papers Inc.	94%	Public
Continental Fibre Co.	--	--
Kimberly-Clark Corp.	92%	Public
Nekoosa Paper Co.	96%	Public
Rising Paper Co.	--	--
Simpson Paper Co.	--	--
Harding-Jones Paper Co.	--	--
James River Corp.	29%	Public
Southworth Co.	--	--
Eletcher Paper Co.	--	--
Fox River Paper Corp.	--	--

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Cotton fibre papers face competition from chemical wood pulp papers, and their demand varies in response to relative price changes. The long-term trend has been a decline in cotton fibre's market share, due largely to higher costs of cotton fibre production, and this trend is expected to continue (DRI, Pulp and Paper Review, March 1979, p. 16).

Mills

Number of Mills

The 19 firms in this product sector control 23 mills which produce cotton fibre papers. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
8	35%	Misc. Integrated Mills
9	39%	Nonintegrated Fine Papers
*	*	Nonintegrated Fiber & Nonwoven
*	*	Misc. Nonintegrated Mills
23	100%	

Source: 308 Survey.

Size

The average mill capacity is 66 tons per day, with a standard deviation of 64; the median capacity is 52 tons per day (308 Survey).

Location

Cotton fibre paper producing mills are located in the northeast and north central parts of the United States as follows:

Region	Number of Mills
Northeast	12 (52%)
Southeast	* (*%)
North Central	* (*%)
Northwest	0 (0%)
West and Southwest	0 (0%)
	23

Source: 308 Survey.

Indirect Dischargers

Sixteen mills, or 70 percent of the mills in the cotton fibre product sector, are indirect dischargers. The percents of mills in each region which are indirect dischargers are as follows:

Region	% of Mills
Northeast	75
Southeast	*
North Central	*
Northwest	0
West and Southwest	0

Source: 308 Survey

Planned Capacity Expansion

Planned daily capacity expansion in the cotton fibre product sector is expected to be 10 short tons per day. This represents an expansion of capacity in three mills. This expansion will be an increase of 1.8 percent in the capacity to produce cotton fiber paper by all mills. A capital investment of $987,000 is planned for this expansion. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure. (308 Survey)

Assuming 309 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion reported in response to the 308 Survey equals 3,000 tons annually. Capacity reduction as reported in the API Survey from 1978 to 1982 is 2,000 tons annually (API Survey). The 308 Survey reported capacity expansion for the cotton fibre product sector is thus approximately equal to future capacity as reported by API.

Age and Productivity

The age structure in the cotton fibre product sector is very old. There have been no new mills or machines recently added. Productivity growth in this product sector is low (1 to 2 percent per year), and the degree of technological obsolesence is high. (Discussions with DRI Pulp and Paper Service staff, August 2, 1979.) Capital investment during the past five years by mills producing in this product sector totals $52,787,000. Investment per unit capacity equals $35,000, which is moderately low compared to the industry as a whole. (308 Survey) (Note: High capital investmend does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the cotton fibre product sector employed roughly 1,900 people in 1978. This represented approximately 0.8 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

All other paper is defined in this report as the residual category for all paper products not otherwise classified.

Firms in Product Sector

There are 18 U.S. firms that produce all other paper. The major producers are:

Appleton Papers Division of NCR
Kimberly-Clark Corp.
Boise Cascade Corp.
Deerfield Specialty Papers, Inc.
Philip Morris Ind. Paper Group
Sorg Paper Co.
Weyerhaeuser Co.
Brown Co.
P.H. Glatfelter Co.
Scott Paper Co.

Source: Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 45.5 percent, and the top eight firms' capacity share was 66.4 percent. This is thus a moderately concentrated product sector . (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.)

Total Capacity and Utilization Rate

U.S. capacity to produce all other paper is 665* tons per day, or 0.33 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). No capacity utilization rate data are available.

Vertical Integration

No information is available on the level of vertical integration of firms in this sector. Eleven mills, or 50 percent of the mills in this product sector, include converting operations (308 Survey).

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*One mill in this product sector did not report capacity data and was not included in this total.

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors, as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Appleton Papers Division of NCR	--	--
Kimberly-Clark Corp.	92%	Public
Boise Cascade Corp.	53%	Public
Deerfield Specialty Papers, Inc.	--	--
Philip Morris Ind. Paper Group	5%	Public
Sorg Paper Co.	--	--
Weyerhaeuser Co.	43%	Public
Brown Co.	78%	Public
P.H. Glatfelter Co.	100%	Public
Scott Paper Co.	92%	Public
Crown Zellerbach Corp.	55%	Public
Georgia-Pacific Corp.	20%	Public
James River Corp.	29%	Public
Knowlton Brothers	--	--
Monadnock Paper Mills, Inc.	--	--

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Lack of available data prevents a discussion of economic and technological trends for this product sector.

Mills

Number of Mills

The 18 firms in this product sector control 22 mills which produce all other paper. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*	BCT Bleached Kraft
*	*	Fine Bleached Kraft & Soda
*	*	Papergrade Sulfite
*	*	Misc. Integrated Mills

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*	Paperboard from Wastepaper
*	*	Misc. Secondary Fiber Mills
*	*	Nonintegrated Fine Papers
*	*	Nonintegrated Filter & Nonwoven
*	*	Nonintegrated Paperboard
*	*	Misc. Nonintegrated Mills
22	100%	

Source: 308 Survey.

Size

The average mill capacity is 236 tons per day, with a standard deviation of 377; the median capacity is 75 tons per day (308 Survey).

Location

All other paper producing mills are located primarily in the Northeast, with a regional breakdown as follows:

Region	Number of Mills
Northeast	14 (64%)
Southeast	* (*%)
North Central	* (*%)
Northwest	0 (0%)
West and Southwest	* (*%)
	22

Source: 308 Survey.

Indirect Dischargers

Eleven mills, or 50 percent of the mills in the all other paper grade product sector, are indirect dischargers. The percents of mills in each region which are indirect dischargers are given on the following page.

Region	% of Mills
Northeast	*
Southeast	0
North Central	*
Northwest	0
West and Southwest	0

Source: 308 Survey.

Planned Capacity Expansion

Planned daily capacity expansion in the all other paper product sector is expected to be 33 short tons per day. This represents an expansion of capacity in four mills. This expansion will be an increase of 5.0 percent in production of all other paper by all mills. A capital investment of $1,175,000 is planned for this expansion. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure. (308 Survey) American Paper Institute capacity expansion data are unavailable for the all other paper product sector, and, therefore, no comparison is possible.

Age and Productivity

It is not possible to estimate the age structure in the all other paper product sector, as no information is available on new mills or machinery. Nor are data available concerning productivity growth and technological obsolescence in the sector. Capital investment during the past five years by mills producing in this product sector totals $620,265,000. Investment per unit capacity equals $89,000, which is very high compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the all other paper product sector employed roughly 1,800 people in 1978. This represented approximately 0.7 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Unbleached Kraft linerboard is defined in this report as paperboard made from a furnish containing not less than 80 percent wood pulp produced by the Kraft process, manufactured for use as facing material when combining paperboard for conversion into corrugated or solid fiber boxes. It includes solid unbleached Kraft linerboard, both Fourdrinier and Cylinder, mottle white linerboard, and clay coated unbleached Kraft linerboard.

Firms in Product Sector

There are 29 U.S. firms that produce unbleached Kraft linerboard. The major producers are:

International Paper Co.
Weyerhaeuser Co.
Georgia Kraft Co.
St. Regis Paper Co.
Union Camp Corp.
Container Corp. of America
Owens-Illinois, Inc.
Continental Forest Industries
Nekoosa Papers, Inc.

Source: Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 37.8 percent, and the top eight firms' capacity share was 51.1 percent. This is thus an unconcentrated product sector. (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates). Because of barriers to entry, posed primarily by the vertical integration requirements in Kraft linerboard production, this sector will likely become more concentrated. New entrants are unlikely except through the acquisition of existing firms.

Total Capacity and Utilization Rate

U.S. capacity to produce unbleached Kraft linerboard is 42,424* tons per day, or 20.98 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). In 1979, U.S. firms' estimated capacity utilization rate was 94.5 percent (Pulp and Paper, January 1979 estimate).

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*One mill in this product sector did not report capacity data and was not included in this total.

Vertical Integration

Most firms in this product sector are backward integrated; that is, they own timber lands and/or lease lands for timber-cutting purposes. About 75 percent of production volume is provided by forward integrated firms, using at least 50 percent of their board production in their own converting operations. The only major nonforward integrated firm is Great Southern, part of Great Northern Nekoosa. (Fibre Box Assn. and DRI estimates.) Four mills, or 8.3 percent of the mills in this product sector, include converting operations (308 Survey).

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors, as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
International Paper Co.	79%	Public
Weyerhaeuser Co.	43%	Public
Georgia Kraft Co.	--	--
St. Regis Paper Co.	82%	Public
Union Camp Corp.	89%	Public
Container Corp. of America	100%	Public
Owens-Illinois, Inc.	19%	Public
Continental Forest Industries	22%	Public
Nekoosa Papers, Inc.	96%	Public
Packaging Corp. of America	100%	Public
Westvaco Corp.	90%	Public
Champion International	47%	Public
Boise Cascade Corp.	53%	Public
Crown Zellerbach Corp.	55%	Public
St. Joe Paper Co.	--	--

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Demand for Kraft linerboard relates directly to the shipping container requirements of the full spectrum of American industry; thus, it is strongly influenced by the main macroeconomic indicators, including the industrial production index and GNP. The only real competitive threat to shipping containers made from unbleached linerboard and corrugating medium comes from the use of heavy-gauge shrink plastic film (film which can be wrapped around a pallet of packages and then shrunk by heating to hold the load

securely). The superior cost/performance characteristics of corrugated containers, however, limit shrink film competition to very few applications. Other products have not encroached significantly into linerboard markets. (ADL, 1977, p. 15)

Mills

Number of Mills

The 29 firms in this product sector control 48 mills which produce unbleached Kraft linerboard. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
17	35%	Unbleached Kraft (Linerboard)
10	21%	Unbleached Kraft & Semi-Chemical
6	13%	Unbleached Kraft (Bag)
15	31%	Misc. Integrated Mills
48	100%	

Source: 308 Survey.

Size

The average mill capacity is 1,342 tons per day, with a standard deviation of 552; the median capacity is 1,255 tons per day (308 Survey).

Location

Unbleached Kraft linerboard producing mills are concentrated in the southeastern United States as follows:

Region	Number of Mills
Northeast	0 (0%)
Southeast	34 (71%)
North Central	0 (0%)
Northwest	9 (19%)
West and Southwest	5 (10%)
	48

Source: 308 Survey.

Indirect Dischargers

Fewer than five of the mills in the unbleached Kraft linerboard product sector are indirect dischargers. The percents of mills in each region which are indirect dischargers are as follows:

Region	% of Mills
Northeast	0
Southeast	*
North Central	0
Northwest	0
West and Southwest	0

Source: 308 Survey.

Planned Capacity Expansion

Planned daily capacity expansion in the unbleached Kraft linerboard product sector is expected to be 3,874 short tons per day. This represents an expansion of capacity in 17 mills. This expansion will be an increase of 9.1 percent in the capacity to produce unbleached Kraft linerboard by all mills. A capital investment of $363,656,000 is planned for this expansion. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure. (308 Survey)

Assuming 354 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion reported in response to the 308 Survey equals 1,371,000 tons annually. Capacity expansion as reported in the API Survey from 1978 to 1982 is 1,774,000 tons annually (API Survey). The 308 Survey reported capacity expansion for the unbleached Kraft linerboard product sector is thus lower than capacity expansion reported by API.

Age and Productivity

The age structure in the unbleached Kraft linerboard product sector is quite young; over 50 percent of the mills date from the 1960s or more recently. The percent of new machines is high, with more expected to be coming on-stream in the next three years. The associated productivity growth was very high (4 to 5 percent) in the 1960s and has slowed in the 1970s. There is no technological obsolescence in this sector; most mills are large and efficient. (Discussions with DRI Pulp and Paper Service staff, August 2, 1979). Capital investment during the past five years by mills producing in this product sector totals $2,000,921,000. Investment per unit capacity equals $31,000, which is low compared to the industry as a

whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the unbleached Kraft linerboard product sector employed roughly 27,300 people in 1978. This represented approximately 10.9 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Bleached Kraft linerboard is defined in this report as paperboard made from a furnish containing not less than 80 percent bleached virgin chemical wood pulp, manufactured for use as display stands and advertising board, and for converting into cigarette and similar types of boxes.

Firms in Product Sector

There are six U.S. firms that produce bleached Kraft linerboard. The major producers are:

Temple Eastex, Inc.
Scott Paper Co.
International Paper Co.
Longview Fibre Co.
St. Regis Paper Co.
Gilman Paper Co.

Source: Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 98.3 percent and the top six firms' capacity share was 100 percent. This is thus a highly concentrated product sector. (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates).

Total Capacity and Utilization Rate

U.S. capacity to produce bleached Kraft linerboard is 315 tons per day, or 0.16 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). The 1979 capacity utilization rate for U.S. firms producing bleached Kraft linerboard is estimated at 103.5 percent (DRI, Pulp and Paper Review, August 1979, pp. 53-54, estimate).

Vertical Integration

Most firms in this product sector are backward integrated, that is, they own timberlands and/or lease lands for timber cutting purposes. About 75 percent of production volume is produced by forward integrated firms, using at least 50 percent of their board production in their own converting operations. (Fibre Box Assn. and DRI estimates). Two mills, or 33.3 percent of the mills in this product sector include converting operations (308 Survey).

Horizontal Integration

The six largest firms are horizontally integrated to other economic production sectors as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Temple Eastex, Inc.	--	--
Scott Paper Co.	92%	Public
International Paper Co.	79%	Public
Longview Fibre Co.	83%	Public
St. Regis Paper Co.	82%	Public
Gilman Paper Co.	--	--

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Bleached Kraft linerboard is a very small sector of the paperboard industry. It is a higher quality linerboard than unbleached. Forecasts are for bleached linerboard to remain at roughly .8 percent of total linerboard production (DRI discussions).

Mills

Number of Mills

The six firms in this product sector control six mills which produce bleached Kraft linerboard. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*%	Market Bleached Kraft
*	*%	BCT Bleached Kraft
*	*%	Misc. Integrated Mills
6	100%	

Source: 308 Survey.

Size

The average mill capacity is 1,660 tons per day, with a standard deviation of 522; the median capacity is 1,613 tons per day (308 Survey).

Location

Bleached Kraft linerboard producing mills are located mainly in the Southeast, with a regional breakdown as follows:

Region	Number of Mills
Northeast	0 (0%)
Southeast	* (*%)
North Central	0 (0%)
Northwest	* (*%)
West and Southwest	* (*%)
	6

Source: 308 Survey.

Indirect Dischargers

No mills in the bleached Kraft linerboard product sector are indirect dischargers (308 Survey).

Planned Capacity Expansion

The bleached Kraft linerboard product sector includes only one mill with plans for capacity expansion. This information is therefore confidential (308 Survey). Capacity expansion as reported in the API Survey from 1978 to 1982 is 17,000 tons annually (API Survey). Thus the 308 Survey reported capacity expansion for the bleached Kraft linerboard product sector cannot be compared to capacity expansion reported by API.

Age and Productivity

The age structure in the bleached Kraft linerboard product sector is quite new with most mills dated from the 1960s or more recently and a high percentage of new machines. Productivity growth in this product sector is moderate (3 percent per year) and the degree of technical obsolescence is moderate. (Discussions with DRI Pulp and Paper Service staff, August 2, 1979.) Capital investment during the past five years by mills producing in this product sector totals $318,717,000. Investment per unit capacity equals $32,000, which is low compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the bleached Kraft linerboard product sector employed roughly 350 people in 1978. This represented approximately 0.1 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Bleached foldingboard is defined in this report as paperboard made from a furnish containing not less than 80 percent virgin bleached chemical wood pulp, for conversion into folding cartons, such as containers for ice cream, butter, oleomargarine, bakery products, frozen foods, cosmetics, and drugs.

Firms in Product Sector

There are 13 U.S. firms that produce bleached foldingboard. The major producers are:

International Paper Co.
Continental Forest Industries
Potlatch Corp.
Federal Paper Board Co., Inc.
Container Corp. of America
Weyerhaeuser Co.
Union Camp Corp.
Gilman Paper Co.

Source: Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 70.6 percent and the top eight firms' capacity share was 86.3 percent. This is thus a concentrated product sector. (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates).

Total Capacity and Utilization Rate

U.S. capacity to produce bleached foldingboard is 6,510* tons per day, or 3.22 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). The 1979 capacity utilization rate for U.S. firms producing bleached foldingboard was 92.5 percent (DRI, Pulp and Paper Review, pp. 64-65 estimate).

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*Two mills in this product sector did not report capacity data and were not included in this total.

Vertical Integration

Most firms in this product sector are backward integrated, that is, they own timberlands and/or lease lands for timber cutting purposes. Seventy-five to 80 percent by production volume of this sector is forward integrated to converting of boxboard to foldingboard. A forward integrated firm is here defined as a firm which owns a converting operation. The firm may not convert all of its production. (Fibre Box Assn. and DRI estimates). Nine mills or 53 percent of the mills in this product sector include converting operations (308 Survey).

Horizontal Integration

The 13 largest firms are horizontally integrated to other economic production sectors as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
International Paper Co.	79%	Public
Continental Forest Industries	22%	Public
Potlatch Corp.	64%	Public
Federal Paper Board Co., Inc.	98%	Public
Container Corp. of America	100%	Public
Weyerhaeuser Co.	43%	Public
Union Camp Corp.	89%	Public
Gilman Paper Co.	--	--
Fiberboard Corp.	--	--
Scott Paper Co.	92%	Public
Westvaco Corp.	90%	Public
Temple Eastex, Inc.	--	--
Crown Zellerbach Corp.	55%	Public

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Foldingboard is used almost exclusively in the manufacture of folding cartons, of which the three most important bleached kinds are medical, wet food, and beverage packaging. Long-term demand for medical foldingboard has been increasing due to:

- long-term increases in demands for health care and medical products;
- movement toward unit dose packaging by hospitals and retail pharmacies;

- o penetration into new markets such as disposable sanitary products; and
- o an increase in consumption of over-the-counter drugs.

Wet food packaging cartons face severe competition from plastics films and pouches, especially in the frozen vegetable sector, and from hard thermoplastics in the butter and margarine packaging sectors. Plastic container and flexible packaging pose competition to several bleached foldingboard markets. Also, declining basis weights for board require more square feet of packaging per ton. Continued slow growth in this sector is expected. (DRI, Pulp and Paper Review, December 1977, pp. 93-101).

Mills

Number of Mills

The 13 firms in this product sector producing bleached foldingboard control 17 mills. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*%	Market Bleached Kraft
*	*%	BCT Bleached Kraft
7	41%	Misc. Integrated Mills
*	*%	Paperboard from Wastepaper
*	*%	Nonintegrated Fine Papers
17	100%	

Source: 308 Survey.

Size

The average mill capacity is 1,172 tons per day, with a standard deviation of 430; the median capacity is 1,264 tons per day (308 Survey).

Location

Bleached foldingboard producing mills are located mainly in the Southeast, with a regional breakdown as follows:

Region	Number of Mills
Northeast	* (*%)
Southeast	11 (65%)
North Central	* (*%)
Northwest	* (*%)
West and Southwest	* (*%)
	17

Source: 308 Survey.

Indirect Dischargers

Fewer than five of the mills in the bleached foldingboard product sector are indirect dischargers. Because so few mills in this sector are indirect dischargers, the location information remains confidential (308 Survey).

Planned Capacity Expansion

Planned daily capacity expansion in the bleached foldingboard product sector is expected to be 162 short tons per day. This represents an expansion of capacity in four mills. This expansion will be an increase of 2.5 percent in the capacity to produce bleached foldingboard by all mills. A capital investment of $28,600,000 is planned for this expansion. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure. (308 Survey)

Assuming 357 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion reported in response to the 308 Survey equals 58,000 tons annually. Capacity expansion as reported in the API Survey from 1978 to 1982 is 223,000 tons annually (API Survey). The 308 Survey reported capacity expansion for the bleached foldingboard product sector is thus lower than capacity expansion reported by API.

Age and Productivity

The age structure in the bleached foldingboard product sector is fairly new. 1960s-vintage mills predominate and there have recently been quite a few new machines added. Productivity growth in this product sector is moderate (3 percent per year), and the degree of technological obsolescence is moderate. (Discussions with DRI Pulp and Paper Service staff, August 2, 1979). Capital investment during the past five years by mills producing in this product sector totals $1,157,009,000. Investment per unit capacity equals $58,000, which is moderately high compared to the

industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the bleached foldingboard product sector employed roughly 6,000 people in 1978. This represented approximately 2.4 percent of total pulp, paper, and paperboard mill employment. Meta Systems estimates based on E.C. Jordan estimates.)

Product Sector

Definition of Product Sector

Solid bleached board is defined in this report as paperboard made from a furnish containing not less than 80 percent virgin bleached chemical wood pulp, for conversion into milk carton, heavyweight cup and round nested food container, plate, dish and tray, and into packaging for moist, liquid, and oily foods, for blister packs, tubes and other products not classified elsewhere, and for industrial products not classified under bleached bristol and for export.

Frims in Product Sector

There are 17 U.S. firms that produce solid bleached board. The major producers are:

Westvaco Corp.
International Paper Co.
Champion International
Temple Eastex, Inc.
Gulf States Paper Corp.
Container Corp. of America
Georgia-Pacific Corp.
American Can Co.

Source: Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.)

Concentration

In 1978, the top five firms' capacity share was 58.8 percent and the top eight firms' capacity share was 79.2 percent. This is thus a concentrated product sector. (Meta Systems estimates based on Lockwood's, DRI estimates and E.C. Jordan estimates.)

Total Capacity and Utilization Rate

U.S. capacity to produce solid bleached board is 5,425* tons per day, or 2.68 percent of total U.S. paper, paperboard, and market pulp production capacity. (308 Survey) The 1979 capacity utilization rate for U.S. firms producing bleached paperboard (including foldingboard, milk carton, linerboard, etc.) was 89.9 percent. (Pulp and Paper, August 1979, estimate).

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*One mill in this product sector did not report capacity data and was not included in this total.

Vertical Integration

Most firms in this product sector are backward integrated, that is, they own timberlands and/or lease lands for timber cutting purposes. Seventy-five to 80 percent by production volume of this sector is forward integrated to converting. A forward integrated firm is here defined as a firm which owns a converting operation. The firm may not convert all of its production. (Fibre Box Assn. and DRI estimates) Seven mills or 37 percent of the mills in this product sector include converting operations (308 Survey).

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Westvaco Corp.	90%	Public
International Paper Co.	79%	Public
Champion International	47%	Public
Temple Eastex, Inc.	--	--
Gulf States Paper Corp.	--	--
Container Corp. of America	100%	Public
Georgia-Pacific Corp.	20%	Public
American Can Co.	9%	Public
Potlatch Corp.	64%	Public
Weyerhaeuser Co.	43%	Public
Union Camp Corp.	89%	Public
Federal Paper Board Co., Inc.	98%	Public
Gilman Paper Co.	--	--
St. Regis Paper Co.	82%	Public
Scott Paper Co.	92%	Public

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

The recycled milk carton market ended in 1973 with passage of laws prohibiting use of waste material for milk cartons. As with several other paperboard sectors, virgin fiber milk carton faces severe competition from plastics. The historical milk packaging trend has been from glass to paperboard and now to plastic. Also there is a trend toward sales of larger sizes of milk containers which lowers the paperboard requirement

per unit of milk. Overall demand for solid bleached milk carton has declined since about 1970.

Two other trends are noteworthy in this sector. One is the major competition from plastics for the drinking cup market. The other is the substitutability of molded pulp products, such as trays, for several solid bleached all other products. (DRI estimates)

Mills

Number of Mills

The 17 firms in this product sector control 19 mills which produce solid bleached board. These are listed below by production subcategory. subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*%	Market Bleached Kraft
*	*%	BCT Bleached Kraft
10	53%	Misc. Integrated Mills
*	*%	Paperboard from Wastepaper
19	100%	

Source: 308 Survey

Size

The average mill capacity is 1,314 tons per day, with a standard deviation of 473; the median capacity is 1,400 tons per day (308 Survey).

Location

A majority of solid bleached board producing mills are located in the Southeast, with a regional breakdown as follows:

Region	Number of Mills
Northeast	* (*%)
Southeast	13 (68%)
North Central	0 (0%)
Northwest	* (*%)
West and Southwest	* (*%)
	19

Source: 308 Survey.

Indirect Dischargers

Fewer than five of the mills in the solid bleached board product sector are indirect dischargers. (308 Survey) For the purposes of confidentiality, no location statistics can be provided.

Planned Capacity Expansion

Planned daily capacity expansion in the solid bleached board product sector is expected to be 121 short tons per day. This represents an expansion of capacity in three mills. This expansion will be an increase of 2.2 percent in the capacity to produce solid bleached board by all mills. A capital investment of $23,300,000 is planned for this expansion. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure. (308 Survey)

Assuming 356 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion reported in response to the 308 Survey equals 43,000 tons annually. Capacity expansion as reported in the API Survey from 1978 to 1982 is 58,000 tons annually (API Survey). The 308 Survey reported capacity expansion for the solid bleached board product sector is thus slightly lower than capacity expansion reported by API.

Age and Productivity

The age structure in the solid bleached board sector is fairly new. There were many new mills built in the 1960s and quite a few new machines recently added. Productivity growth in this product sector is moderate (3 percent per year) and the degree of technical obsolescence is also moderate. (Discussions with DRI Pulp and Paper Service staff, August 2, 1979.) Capital investment during the past five years by mills producing in this product sector totals $1,379,255,000. Investment per unit capacity equals $53,000, which is moderate compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the solid bleached board product sector employed roughly 5,100 people in 1978. This represented approximately 2.0 percent of the total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Semi-chemical corrugating medium in this report is defined as paperboard made from a furnish containing not less than 75 percent virgin wood pulp, the predominant portion of which is produced by a semi-chemical process, used as the fluting material when combining paperboard for conversion into corrugated boxes.

Firms in Product Sector

There are 29 U.S. firms that produce semi-chemical corrugating medium. The major producers are:

Owens-Illinois, Inc.
International Paper Co.
Weyerhaeuser Co.
Champion International
Mead Corp.
Menasha Corp.
Packaging Corp. of America
Stone Container Corp.

Source: Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 36.4 percent and the top eight firms' capacity share was 50.5 percent. This is thus an unconcentrated product sector. (Meta Systems estimates baed on Lockwood's, DRI estimates, and E.C. Jordan estimates).

Total Capacity and Utilization Rate

U.S. capacity to produce semi-chemical corrugating medium is 13,756* tons per day or 6.80 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). In 1979, U.S. firms' capacity utilization rate for semi-chemical corrugating medium was 88.8 percent (Pulp and Paper, June 1979 estimate).

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*One mill in this product sector did not report capacity data and was not included in this total.

Vertical Integration

Most of the firms in this product sector are backward integrated, that is, they own or lease timber lands. About 75 percent of production volume is from firms that are forward integrated to converting of corrugated containers. (Fibre Box Assn. and DRI estimates). Two mills or 5 percent of the mills in this product sector include converting operations (308 Survey).

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Owens-Illinois, Inc.	19%	Public
International Paper Co.	79%	Public
Weyerhaeuser Co.	43%	Public
Champion International	47%	Public
Mead Corp.	44%	Public
Menasha Corp.	--	--
Packaging Corp. of America	100%	Public
Stone Container Corp.	97%	Public
Western Kraft Paper Group, Willamette Industries, Inc.	53%	Public
Inland Container Corp.	--	--
Continental Forest Industries	22%	Public
Virginia Fibre Corp.	--	--
Union Camp Corp.	89%	Public
Nekoosa Papers, Inc.	96%	Public
Sonoco Products Co.	35%	Public

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Corrugated containers in which semi-chemical corrugating medium is a central ingredient have become established as an essential low-cost packaging material with few substitutes. Demand for corrugated containers is directly related to the shipping container requirements of the full spectrum of American industry; thus, it is strongly influenced by the main macroeconomic indicators including the industrial production index and GNP. (ADL, 1977, p. 15)

Mills

Number of Mills

The 29 firms in this product sector control 37 mills which produce semi-chemical corrugating medium. These are listed below by production subcategory:

Number of of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
18	49%	Semi-Chemical
10	27%	Unbleached Kraft and Semi-Chemical
*	*%	Papergrade Sulfite
*	*%	Misc. Integrated Mills
37	100%	

Source: 308 Survey.

Size

The average mill capacity is 1,050 tons per day, with a standard deviation of 730; the median capacity is 858 tons per day (308 Survey).

Location

Many semi-chemical corrugating medium producing mills are located in the Southeast with others throughout the United States, as follows:

Region	Number of Mills
Northeast	* (*%)
Southeast	18 (49%)
North Central	9 (24%)
Northwest	7 (19%)
West and Southwest	* (*%)
	37

Source: 308 Survey.

Indirect Dischargers

Fewer than five of the mills in the semi-chemical corrugating medium product sector are indirect dischargers. The percents of mills in each region which are indirect dischargers are as follows:

Region	% of Mills
Northeast	0
Southeast	*
North Central	*
Northwest	0
West and Southwest	0

Source: 308 Survey.

Planned Capacity Expansion

Planned daily capacity expansion in the semi-chemical corrugating medium product sector is expected to be 362 short tons per day. This represents an expansion of capacity in four mills. This expansion will be an increase of 2.6 percent in the capacity to produce semi-chemical corrugating medium by all mills. A capital investment of $18,886,000 is planned for this expansion. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure. (308 Survey)

Assuming 353 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion reported in response to the 308 Survey equals 128,000 tons annually. Capacity expansion as reported in the API Survey from 1978 to 1982 is 524,000 tons annually (API Survey). The 308 Survey reported capacity expansion for the semi-chemical corrugating medium product sector is thus lower than capacity expansion reported by API.

Age and Productivity

The age structure in the semi-chemical corrugating medium product sector is new since many mills were added in the 1960s and there is a high proportion of new machines. Productivity growth in this product sector was high (4 percent per year) in the 1960s and slowed in the 1970s. The degree of technological obsolescence is very low. (Discussions with DRI Pulp and Paper Service staff, August 2, 1979). Capital investment during the past five years by mills producing in this product sector totals $1,734,363,000. Investment per unit capacity equals $45,000, which is moderate compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the semi-chemical corrugating product sector employed roughly 7,700 people in 1978. This represented approximately 3.1 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Recycled linerboard in this report is defined as paperboard manufactured from a combination of recycled fibers from various grades of paper stock and containing less than 80 percent virgin Kraft wood pulp. It is used as facing material when combining paperboard for conversion into corrugated or solid fiber boxes and is often called "test" linerboard.

Firms in Product Sector

There are 20 U.S. firms that produce recycled linerboard. The major producers are:

Whippany Paper Board Co., Inc.
Container Corp. of America
Clevepak Corp.
Menominee Paper Co., Inc.
Sweetwater Paper Board Co.
Grief Board Corp.
Inland Container Corp.
Packaging Corp. of America
Time Container Corp.

Source: Meta Systems estimates based on Lockwood's, DRI estimates and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 51.6 percent and the top eight firms' capacity share was 65.2 percent. This is thus a moderately concentrated product sector. (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.)

Total Capacity and Utilization Rate

U.S. capacity to produce recycled linerboard is 3,053 tons per day or 1.51 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). The 1979 capacity utilization rate was estimated at 74.5 percent (DRI, Pulp and Paper Review, August 1979, pp. 53-54 estimate).

Vertical Integration

Pulp sources for firms in this product sector are wastepaper; all firms are integrated backward to wastepaper pulping. About 75 percent of production volume is produced by forward integrated firms using at least 80 percent of their board production in their own converting operations (Fibre Box Assn. and DRI estimates). Six mills, or 24 percent of the mills in this product sector include converting operations (308 Survey).

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Whippany Paper Board Co., Inc.	--	--
Container Corp. of America	100%	Public
Clevepak Corp.	92%	Public
Menominee Paper Co., Inc.	--	--
Sweetwater Paper Board Co.	--	--
Grief Board Corp.	--	--
Inland Container Corp.	--	--
Packaging Corp. of America	100%	Public
Time Container Corp.	11%	Public
Consolidated Papers, Inc.	79%	Public
Union Camp Corp.	89%	Public
Connelly Containers, Inc.	--	--
Menasha Corp.	--	--
Pacific Coast Packaging Corp.	--	--
Crown Zellerbach Corp.	55%	Public

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

As with unbleached Kraft linerboard, recycled linerboard as a key component in paperboard boxes faces an increasingly mature market; production increases and capacity expansions will depend more on increases in existing markets than on expansion into new areas. In addition, plastics penetration threatens traditional paperboard box markets. Nonetheless, recycled linerboard's near future appears auspicious. A trend toward recycling paperboard is resulting in increased amounts of recycled pulp in "solid" linerboard production. This will likely continue. Several

recent incremental expansions at unbleached Kraft linerboard mills have emphasized recycled pulp use, partly because this requires smaller capital investment and pollution control expenditures. (Secondary fiber systems have smaller waste loads per ton of capacity than does virgin fiber.) The recycled pulping process also requires less energy than virgin fiber, but this can be negated partially or wholly by the problems and costs of removing foreign particles and chemicals, such as adhesives.

Thus, within the paperboard box market sector, recycled linerboards' role will gain in importance as demand for recycled linerboard increases faster than the overall containerboard sector. (Discussions with DRI Pulp and Paper Service staff; DRI, Pulp and Paper Review, August 1979, pp. 48-50.)

Mills

Number of Mills

The 20 firms in this product sector control 25 mills which produce recycled linerboard. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*%	Paperboard from Wastepaper
*	*%	Misc. Secondary Fiber Mills
25	100%	

Source: 308 Survey.

Size

The average mill capacity is 215 tons per day, with a standard deviation of 202; the median capacity is 140 tons per day (308 Survey).

Location

Recycled linerboard producing mills are located throughout the United States with a regional breakdown as follows:

Region	Number of Mills
Northeast	7 (28%)
Southeast	* (*%)
North Central	8 (32%)
Northwest	* (*%)
West and Southwest	* (*%)
	25

Source: 308 Survey.

Indirect Dischargers

Thirteen mills or 52 percent of the mills in the recycled linerboard product sector are indirect dischargers. The percents of mills in each region which are indirect dischargers are as follows:

Region	% of Mills
Northeast	*
Southeast	*
North Central	*
Northwest	*
West and Southwest	*

Source: 308 Survey.

Planned Capacity Expansion

Planned daily capacity expansion in the recycled linerboard product sector is expected to be 88 short tons per day. This represents an expansion of capacity in six mills. This expansion will be an increase of 2.9 percent in the capacity to produce recycled linerboard by all mills. A capital investment of $3,128,000 is planned for this expansion. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure. (308 Survey) Assuming 338 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion reported in response to the 308 Survey equals 30,000 tons annually. Capacity expansion as reported in the API Survey from 1978 to 1982 is 52,000 tons annually (API Survey). The 308 Survey reported capacity expansion for the recycled linerboard product sector is thus slightly lower than capacity expansion reported by API.

Age and Productivity

The age structure in the recycled linerboard product sector is generally old. There have been few new mills or machines recently added. Productivity growth in this product sector is low (1 to 2 percent per year) and the degree of technological obsolescence is high. (Discussions with DRI Pulp and Paper Service staff, August 2, 1979.) Capital investment during the past five years by mills producing in this product sector totals $173,764,000. Investment per unit capacity equals $32,000, which is low compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the recycled linerboard product sector employed roughly 2,400 people in 1978. This represented approximately 1.0 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Recycled corrugating medium in this report is defined as paperboard produced from a furnish containing less than 75 percent virgin wood pulp and from a combination of recycled fibers, which is used as the fluting material when combining paperboard for conversion into corrugated boxes and often called "bogus" medium. The recycled corrugating medium product sector also includes container ship and filler board, recycled paperboard used as a filler for solid fiberboard and as a facing for interior packing products.

Firms in Product Sector

There are 20 U.S. firms that produce recycled corrugating medium. The major producers are:

Container Corp. of America
Alton Box Board Co.
St. Regis Paper Co.
Inland Container Corp.
Whippany Paper Board Co., Inc.
Mead Corp.
Newark Boxboard Co.
Cornwall Paper Mills Co.

Source: Meta Systems estimates based on Lockwood's, DRI estimates, a E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 59.5 percent and the top eight firms' capacity share was 76.7 percent. This is thus a moderately concentrated product sector (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates).

Total Capacity and Utilization Rate

U.S. capacity to produce recycled corrugating medium is 3,900* tons per day or 1.93 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). In 1979, U.S. firms' capacity utilization rate was 93.1 percent (Pulp and Paper, June 1979 estimate).

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*One mill in this product sector did not report capacity data and was not included in this total.

Vertical Integration Rate

Firms in this sector are integrated to their pulping source which is wastepaper. About 50 percent of the firms are forward integrated to converting (Fibre Box Assn. and DRI estimates). Seven mills, or 26 percent of the mills in this product sector include converting operations (308 Survey).

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Container Corp. of America	100%	Public
Alton Box Board Co.	92%	Public
St. Regis Paper Co.	82%	Public
Inland Container Corp.	--	--
Whippany Paper Board Co., Inc.	--	--
Mead Corp.	44%	Public
Newark Boxboard Co.	--	--
Cornwall Paper Mills Co.	--	--
Crown Zellerbach Corp.	55%	Public
Western Kraft Paper Group, Willamette Industries, Inc.	53%	Public
Clevepak Corp.	92%	Public
Millen Industries	--	--
Crown Paper Board Co., Inc.	--	--
Prairie State Paper Mills, Div. of Chippewa Paper Prod. Co.	--	--
Union Camp Corp.	89%	Public

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Recycled corrugating medium's economic position is a cross between that of recycled linerboard and that of semi-chemical corrugating medium. Like recycled linerboard, recycled corrugating medium will benefit from any national paperboard recycling trends. This type of future movement has particular potential due to the relative ease of collecting containerboard for recycling at, for example, supermarkets where a few people can collect large numbers of boxes. Also, low pollution control expenditures for secondary fiber systems add to recycled corrugating medium's future attractiveness.

At the same time, however, demand for corrugating medium will not increase as rapidly in the near future as in the recent past, since the containerboard market is close to mature. Growth in demand for recycled corrugating medium, therefore, is likely to exceed GNP growth, but not by much. (Discussions with

DRI Pulp and Paper Service staff; DRI, Pulp and Paper Review, August 1979, p. 50.

Mills

Number of Mills

The 20 firms in this product sector control 27 mills which produce recycled corrugating medium. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*	Semi-Chemical
*	*	Misc. Integrated Mills
22	81%	Paperboard from Wastepaper
*	*	Misc. Secondary Fiber Mills
27	100%	

Source: 308 Survey

Size

The average mill capacity is 323 tons per day, with a standard deviation of 312; the median capacity is 189 tons per day (308 Survey).

Location

Many recycled corrugating medium producing mills are located in the north central part of the United States, with a regional breakdown as follows:

Region	Number of Mills
Northeast	7 (26%)
Southeast	* (*%)
North Central	12 (44%)
Northwest	0 (0%)
West and Southwest	* (*%)
	27

Souce: 308 Survey

Indirect Dischargers

Fourteen mills or 52 percent of the mills in the recycled corrugating medium product sector are indirect dischargers. The percentage of mills in each region which are indirect dischargers are as follows:

Region	% of Mills
Northeast	71
Southeast	*
North Central	*
Northwest	0
West and Southwest	*

Source: 308 Survey

Planned Capacity Expansion

Planned daily capacity expansion in the recycled corrugating medium product sector is expected to be 118 short tons per day. This represents an expansion of capacity in four mills. This expansion will be an increase of three percent in the capacity to produce recycled corrugating medium by all mills. A capital investment of $5,632,000 is planned for this expansion. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure. (308 Survey)

Assuming 332 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion reported in response to the 308 Survey equals 39,000 tons annually. Capacity expansion as reported in the API Survey from 1978 to 1982 is 195,000 annually. (API Survey) The 308 Survey reported capacity expansion for the recycled corrugating medium product sector is thus lower than capacity expansion reported by API.

Age and Productivity

The age structure in the recycled corrugating medium product sector is intermediate with some new mills and machines recently added. Associated productivity growth in this product sector is not high (2 to 3 percent per year) and some degree of technological obsolescence exists (discussions with DRI Pulp and Paper Service staff, August 2, 1979). Capital investment during the past five years by mills producing in this product sector totals $171,483,000. Investment per unit capacity equals $20,000, which is low compared to the industry as a whole (308 Survey). (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the recycled corrugating medium product sector employed roughly 2,600 people in 1978. This represented approximately 1.0 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Recycled foldingboard in this report is defined as paperboard manufactured from a combination of recycled fibers from various paper stock grades, with bending quality for conversion into folding cartons (including unlined chipboard, Kraft lined, white lined, and clay coated) with nonbending specifications for conversion into rigid or set-up boxes (including plain chipboard, newlined, white vat lined).

Firms in Product Sector

There are 48 U.S. firms that produce recycled foldingboard. The major producers are:

Federal Paper Board Co., Inc.
Newark Boxboard Co.
Packaging Corp. of America
Container Corp. of America
Brown Co.
Simkins Industries, Incl.
St. Regis Paper Co.
Champion International

Source: Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 37.6 percent and the top eight firms' capacity share was 50.6 percent. This is thus an unconcentrated product sector. (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates).

Total Capacity and Utilization Rate

U.S. capacity to produce recycled foldingboard is 10,037* tons per day, or 4.96 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). The 1979 capacity utilization rate for recycled foldingboard was 89.6 percent and for set-up board was 76.4 percent (DRI, Pulp and Paper Review, August 1979, pp. 63-65, estimates).

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*Five mills in this product sector did not report capacity data and were not included in this total.

Vertical Integration

Pulp sources for firms in this product sector are wastepaper and all firms are integrated backward to wastepaper pulping. About 70 percent by production volume of this sector is forward integrated to converting of boxboard to foldingboard. A forward integrated firm here is defined as a firm which owns a converting operation. The firm may not convert all of its production. (Fibre Box Assn., and DRI estimates.) Twenty-one mills or 28 percent of the mills in this product sector include converting operations (308 Survey).

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Federal Paper Board Co., Inc.	98%	Public
Newark Boxboard Co.	--	--
Packaging Corp. of America	100%	Public
Container Corp. of America	100%	Public
Brown Co.	78%	Public
Simkins Industries, Inc.	--	--
St. Regis Paper Co.	82%	Public
Champion International	47%	Public
Whippany Paper Board Co., Inc.	--	--
Consolidated Packaging Corp.	94%	Public
Chesapeake Paperboard Co.	--	--
Rock-Tenn. Co.	--	--
Columbia Corp.	--	--
Quaker Oats Co.	--	--
White Pidgeon Paper Co., Div. of Artistic Carton Co.	--	--

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Recycled foldingboard enjoys few of the advantages over virgin foldingboard that recycled linerboard and corrugated medium have over their virgin products. Foldingboard's large variety of specific end uses do not allow for its easy collection (e.g., at grocery stores) for recycling. Also, many of foldingboard's fastest growing end uses -- such as food wrappings or medicinal containers -- are markets with strong consumer preferences for cleanliness

and brightness, qualities less prevalent in recycled than in virgin foldingboard.* Further, the encroachment of plastics into the food and nondurable packaging sector has been particularly important. For all these reasons, the recycled foldingboard product sector has a less promising economic future than other recycled paperboard sectors. (Discussions with DRI Pulp and Paper Service staff; DRI, Pulp and Paper Review, August 1979, pp. 58-60.)

Mills

Number of Mills

The 48 firms in this product sector control 75 mills which produce recycled foldingboard. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*	Semi-Chemical
*	*	Paper Grade Sulfite
*	*	Misc. Integrated Mills
*	*	Paperboard from Wastepaper
*	*	Misc. Secondary Fiber Mills
*	*	Nonintegrated Fine Papers
75	100%	

Source: 308 Survey

Size

The average mill capacity is 222 tons per day, with a standard deviation of 178; the median capacity is 160 tons per day (308 Survey).

Location

A high proportion of recycled foldingboard producing mills are located in the northeast and north central United States, with a regional breakdown as follows:

*In fact, government regulations severaly restrain recycled foldingboard's use in food markets.

Region	Number of Mills
Northeast	28 (37%)
Southeast	13 (17%)
North Central	24 (32%)
Northwest	* (*%)
West and Southwest	* (*%)
	75

Source: 308 Survey

Indirect Dischargers

Forty-five mills or 57 percent of the mills in the recycled foldingboard product sector are indirect dischargers. The percents of mills in each region which are indirect dischargers are as follows:

Region	% of Mills
Northeast	57
Southeast	*
North Central	63
Northwest	*
West and Southwest	100

Source: 308 Survey

Planned Capacity Expansion

Planned daily capacity expansion in the recycled foldingboard product sector is expected to be 540 short tons per day. The represents an expansion of capacity in 14 mills. This expansion will be an increase of 5.4 percent in the capacity to produce recycled foldingboard by all mills. A capital investment of $28,925,000 is planned for this expansion. These data apply to projects which were under construction in 1978 or budgeted for expenditure (308 Survey).

Assuming 326 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion as reported in response to the 308 Survey equals 176,000 tons annually. Capacity expansion as reported in the API Survey from 1978 to 1982 is 141,000 tons annually (API Survey). The 308 Survey reported capacity expansion for the recycled foldingboard product sector is thus higher than capacity expansion reported by API.

Age and Productivity

The age structure in the recycled foldingboard product sector is generally old. There have been few new mills or machines recently added, although some machines have been rebuilt. Productivity growth in this product sector is low (1 to 2 percent per year) and the degree of technological obsolescence is moderate. (Discussions with DRI Pulp and Paper Service staff, Ausust 2, 1979). Capital investment during the past five years by mills producing in this product sector totals $236,065,000. Investment per unit capacity equals $14,000, which is very low compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production).

Employment

Meta Systems estimates that the recycled foldingboard product sector employed roughly 11,400 people in 1978. This represented approximately 4.5 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Construction paper and board in this report is defined as paper and board for use as sheathing paper, felts (roofing felts, floor covering, automotive felts, deadening, industrial, pipe covering, refrigerator), asbestos paper and asbestos filled paper, and flexible wood fiber insulation. This sector also includes insulating board -- a fibrous-felted homogeneous panel made by inter-felting of the fibers (e.g., interior building board, wallboard, sound deadening board, acoustical tile, exterior sheathing board, roof insulation board, trailer board, etc.); hard pressed board -- vegetable fiber hardboard with a density 31 pounds or over per cubic foot, treated or tempered or not treated or tempered; and wet machine board -- binders board, shoe board (e.g., counter board, heel board, innersole, etc.), automotive board, chair seat backing, coaster board, luggage, mill board, panel board, table top board, etc.

Firms in Product Sector

There are 44 U.S. firms that produce construction paper and board. The major producers are:

GAF Corp.
Lloyd A. Fry Roofing Co.
Celotex Corp.
Bird & Son, Inc.
Certain-Teed Products Corp.
Flintkote Co.
Johns-Manville Corp.
National Gypsum Co.

Source: Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 52.3 percent and the top eight firms' capacity share was 66.0 percent. This is thus a moderately concentrated product sector (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates).

Total Capacity and Utilization Rate

U.S. capacity to produce construction paper and board is 10,682 tons per day or 5.28 percent of total U.S. paper, paperboard, and market pulp

production capacity (308 Survey). The capacity utilization rate for 1979 is estimated at 76 percent (Pulp and Paper, November 1979 and Meta Systems estimate).

Vertical Integration

Firms producing construction paper and board are typically vertically integrated backward (about 70 percent) to wood or recycled pulp and forward (about 50 percent) to conversion and wholesale distribution of final products (DRI estimates). Thirty-three mills, or 33 percent of the mills in this product sector include converting operations (308 Survey).

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
GAF Corp.	--	--
Lloyd A. Fry Roofing Co.	--	--
Celotex Corp.	--	--
Bird & Son, Inc.	--	--
Certain-Teed Products Corp.	--	--
Flintkote Co.	--	--
Johns-Manville Corp.	80%	Public
National Gypsum Co.	--	--
Homasote Co.	--	--
Tamko Asphalt Products, Inc.	--	--
Boise Cascade Corp.	53%	Public
Armstrong Cork Co.	--	--
Congoleum Corp.	--	--
The Davey Co.	--	--
Nicolet Industries, Inc.	--	--

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Like all building materials, the demand for construction paper subdivides into new construction and replacement (or remodeling) components. The replacement market is a large component because roofing shingles, which require relatively frequent replacement, are the largest end use. Also, floor underlayment and sheathing papers are required for many remodeling projects. Thus, the construction paper and board market does not experience

as severe year-to-year fluctuations in demand as do most other commodity construction materials.

There are no significant direct product substitutes for construction paper and board. However, shifts in other construction materials use have had some impacts, such as the substitution for wooden floors of vinyl tile and wall-to-wall carpeting, which reduced the consumption of underlayment paper (ADL, 1977, p. 42).

Mills

Number of Mills

The 44 firms in this product sector control 99 mills which produce construction paper and board. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*%	Misc. Integrated Mills
29	29%	Paperboard from Wastepaper
61	62%	Builders Paper and Roofing Felt
*	*%	Misc. Secondary Fiber Mills
*	*%	Nonintegrated Paperboard
*	*%	Misc. Nonintegrated Mills
99	100%	

Source: 308 Survey.

Size

The average mill capacity is 135 tons per day, with a standard deviation of 104; the median capacity is 101 tons per day (308 Survey).

Location

Construction paper and board producing mills are located throughout the United States, with a regional breakdown as follows:

Region	Number of Mills
Northeast	25 (25%)
Southeast	22 (22%)
North Central	29 (29%)
Northwest	* (*%)
West and Southwest	* (*%)
	99

Source: 308 Survey.

Indirect Dischargers

Fifty-four mills or 55 percent of the mills in the construction paper and board product sector are indirect dischargers. The percent of mills in each region which are indirect dischargers are as follows:

Region	% of Mills
Northeast	52
Southeast	*
North Central	55
Northwest	*
West and Southwest	60

Source: 308 Survey.

Planned Capacity Expansion

Planned daily capacity expansion in the construction paper and board product sector is expected to be 329 short tons per day. This represents an expansion of capacity in 12 mills. This expansion will be an increase of 3.1 percent in the capacity to produce construction paper and board by all mills. A capital investment of $9,493,000 dollars is planned for this expansion. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure. (308 Survey)

Assuming 324 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion reported in response to the 308 Survey equals 107,000 tons annually. Capacity expansion as reported in the API Survey from 1978 to 1982 is 751,000 tons annually (API Survey). The 308 Survey reported capacity expansion for the construction paper and board product sector is thus lower than capacity expansion reported by API.

Age and Productivity

The age structure in the construction paper and board product sector varies depending on the product produced. There have recently been few new mills added. Productivity growth in this product sector is moderate (3 percent per year), and the degree of technological obsolescence varies with specific process and product. (Discussions with DRI Pulp and Paper Service staff, August 2, 1979). Capital investment during the past five years by mills producing in this product sector totals $134,750,000. Investment per unit capacity equals $10,000, which is very low compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the construction paper and board product sector employed roughly 9,500 people in 1978. This represented approximately 3.8 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

Molded pulp products are defined in this report as all kinds of pressed and molded goods made from various furnishes. Molded pulp products include egg packages, plates, food trays, bottle protectors, and papier-mâché articles.

Firms in Product Sector

There are five U.S. firms that produce molded pulp products. The major producers are:

Diamond International Corp.
Keyes Fibre Co.
Packaging Corp. of America
Formart Containers, Inc.
Owens-Illinois, Inc.

Source: Meta Systems estimates based on Lockwood's, DRI estimates and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 100 percent. This is thus a highly concentrated product sector (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates).

Total Capacity and Utilization Rate

U.S. capacity to produce molded pulp products is 1,033 tons per day, or 0.51 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). Capacity utilization rate data are not available.

Vertical Integration

Most of the firms in this sector are vertically integrated. (DRI estimates) Vertically integrated here means integrated from raw materials (wood, wastepaper, etc.) to converted product.

Horizontal Integration

The five largest firms are horizontally integrated to other economic production sectors as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Diamond International Corp.	54%	Public
Keyes Fiber Co.	--	--
Packaging Corp. of America	100%	Public
Formart Containers, Inc.	--	--
Owens-Illinois, Inc.	19%	Public

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

Molded pulp products can be made into a wide variety of shapes and sizes, and have a high resistance to liquids. This property is particularly important in meat packaging, where excess juices will ordinarily disintegrate a package.

In the late 1960s, molded pulp products began to lose their share of packaging markets to competitive plastic products. Producers are more than compensating for these losses now, however, by expanding into disposable tableware (ADL, 1977).

Mills

Number of Mills

The five firms in this product sector control 14 mills which produce molded pulp products. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*%	Groundwood -- Coarse, Molded, Newsprint
*	*%	Misc. Integrated Mills
*	*%	Paperboard from Wastepaper
7	50%	Wastepaper Molded Products
14	100%	

Source: 308 Survey.

Size

The average mill capacity is 82 tons per day, with a standard deviation of 54; and the median capacity is 69 tons per day (308 Survey).

Location

Molded pulp products producing mills are located throughout the United States, many in the northeast, with a regional breakdown as follows:

Region	Number of Mills
Northeast	6 (43%)
Southeast	* (*%)
North Central	* (*%)
Northwest	* (*%)
West and Southwest	* (*%)
	14

Source: 308 Survey.

Indirect Dischargers

Eight mills or 57 percent of the mills in the molded pulp products product sector are indirect dischargers. The percents of mills in each region which are indirect dischargers are as follows:

Region	% of Mills
Northeast	*%
Southeast	*%
North Central	*%
Northwest	0%
West and Southwest	*%

Source: 308 Survey.

Planned Capacity Expansion

Planned daily capacity expansion in the molded pulp products product sector is expected to be 54 short tons per day. This represents an expansion of capacity in three mills. This expansion will be an increase of 5.2 percent in the capacity to produce molded pulp products by all

mills. A capital investment of $7,332,000 is planned for this expansion. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure. (308 Survey) American Paper Institute capacity expansion data are unavailable for the molded pulp products product sector and therefore no comparison is possible.

Age and Productivity

Data on the age structure in the molded pulp products product sector are not available. Associated productivity growth and technological obsolescence information are also not available. Capital investment during the past five years by mills producing in this product sector totals $31,875,000. Investment per unit capacity equals $28,000, which is low compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the molded pulp products product sector employed roughly 2,700 people in 1978. This represented approximately 1.1 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

Product Sector

Definition of Product Sector

All other paperboard is defined in this report as the residual category for all unbleached Kraft paperboard (including unbleached Kraft foldingboard), all semi-chemical paperboard, and all recycled paperboard for end uses not elsewhere classified. It includes matchbook board, gypsum wallboard facing, recycled paperboard manufactured for use as a liner on gypsum board, and paperboard for uses such as tube, can, drum, file folder, tag, etc.

Firms in Product Sector

There are 38 U.S. firms that produce all other paperboard. The major producers are:

Sonoco Products Co.
U.S. Gypsum Co.
National Gypsum Co.
Olin Kraft, Inc.
Georgia Kraft Co.
Georgia-Pacific Corp.
Celotex Corp.
Packaging Corp. of America

Source: Meta Systems estimates based on Lockwood's, DRI estimates and E.C. Jordan estimates.

Concentration

In 1978, the top five firms' capacity share was 57.2 percent and the top eight firms' capacity share was 71.9 percent. This is thus a concentrated product sector. (Meta Systems estimates based on Lockwood's, DRI estimates, and E.C. Jordan estimates.)

Total Capacity and Utilization Rate

U.S. capacity to produce all other paperboard is 8,137* tons per day, or 4.02 percent of total U.S. paper, paperboard, and market pulp production capacity (308 Survey). The 1979 capacity utilization rate for recycled boxboard and paperboard which includes the main components of all other paperboard (gypsum liner, cone, tube, can, and drum) as well as folding boxboard, set-up boxboard, recycled corrugating medium, and recycled

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*Four mills in this product sector did not report capacity data and were not included in this total.

linerboard, is estimated at 83.3 percent (Pulp and Paper, July 1979). 1979 capacity utilization for unbleached foldingboard was 81.2 percent. (DRI Pulp and Paper Review, August 1979, pp. 64-65 estimate.)

Vertical Integration

Many firms in this product sector use wastepaper as a pulp source and are integrated to wastepaper pulping. Most unbleached board mills also are backward-integrated, i.e., they own timber lands and/or lease lands for cutting timber. Approximately 67 percent of production by volume is provided by firms that are forward integrated to converting (Fibre Box Assn. and DRI estimates). Twenty-one mills, or 31 percent of the mills in this product sector include converting operations (308 Survey).

Horizontal Integration

The 15 largest firms are horizontally integrated to other economic production sectors as indicated by the following earnings percentages:

Firm	Percent Earnings in Paper and Paperboard Sector	Publicly or Privately Owned
Sonoco Products Co.	35%	Public
U.S. Gypsum Co.	--	--
National Gypsum Co.	--	--
Olin Kraft, Inc.	80%	Public
Georgia Kraft Co.	--	--
Georgia-Pacific Corp.	20%	Public
Celotex Corp.	--	--
Packaging Corp. of America	100%	Public
Flintkote Co.	--	--
Alton Box Board Co.	92%	Public
Clevepak Corp.	92%	Public
Mead Corp.	44%	Public
Union Camp Corp.	89%	Public
Stone Container Corp.	97%	Public
Container Corp. of America	100%	Public

Source: Paper Trade Journal, June 30, 1979, pp. 44-47.

Economic and Technological Trends

The most important paperboard product included in all other paperboard is gypsum wallboard facing, which is the liner material used to make gypsum wallboard. Gypsum wallboard (which is made exclusively with a recycled

paperboard liner material) is a well-entrenched construction product used for both new construction and remodelling. As a result, its demand does not fluctuate as sharply as the building cycle. It does face substitution by a variety of other interior wall panelling materials, but this trend has had relatively minor impact thus far.

The next most important product is unbleached foldingboard. Recent technology changes have allowed the production of lighter weight foldingboard. Foldingboard is used almost exclusively in the manufacture of folding cartons. The chief use of unbleached Kraft folding cartons is for beverage carriers. Unbleached Kraft foldingboard is losing market share here due to the beverage industry's shift toward larger glass containers and an increased proportion of canned (as opposed to bottled) beer. Also, the trend toward plastic beverage packagings rather than paperboard cartons hurts the unbleached Kraft foldingboard product sector. However, penetration into other end-use markets will more than offset any share loss in beverage carriers. (DRI, Pulp and Paper Review, April 1978, p. 81.)

Tube, can, and drum stock is a smaller volume product. It consists of paperboard that is wound into spiral cans that range from small orange juice cans to large drums for commodities such as chemicals. Unbleached Kraft paper and paperboard compete strongly in this market.

Plastics have not had an important substitution impact in the major markets of all other paperboard, except unbleached Kraft foldingboard (ADL, 1977).

Mills

Number of Mills

The 38 firms in this product sector control 68 mills which produce all other paperboard. These are listed below by production subcategory:

Number of Mills	Percent of Mills in This Product Sector	Production Subcategory Name
*	*%	Unbleached Kraft & Semi-Chemical
*	*%	Papergrade Sulfite
*	*%	Unbleached Kraft (Bag)
6	9%	Misc. Integrated Mills
48	71%	Paperboard from Wastepaper
*	*%	Wastepaper Molded Products
*	*%	Misc. Secondary Fiber Mills
*	*%	Nonintegrated Paperboard
*	*%	Misc. Nonintegrated Mills
68	100%	

Source: 308 Survey.

Size

The average mill capacity is 339 tons per day, with a standard deviation of 405; the median capacity is 150 tons per day (308 Survey).

Location

All other paperboard producing mills are concentrated in the eastern, southern,and central parts of the United States, as follows:

Region	Number of Mills
Northeast	25 (37%)
Southeast	16 (24%)
North Central	18 (26%)
Northwest	* (*%)
West and Southwest	* (*%)
	68

Source: 308 Survey.

Indirect Dischargers

Twenty-seven mills, or 40 percent of the mills in the all other paperboard product sector are indirect dischargers. The percents of mills in each region which are indirect dischargers are as follows:

Region	% of Mills
Northeast	32
Southeast	*
North Central	61
Northwest	0
West and Southwest	*

Source: 308 Survey.

Planned Capacity Expansion

Planned daily capacity expansion in the all other paperboard product sector is expected to be 149 short tons per day. This represents an expansion of capacity in 12 mills. This expansion will be an increase of 1.8 percent in the capacity to produce all other paperboard by all mills.

A capital investment of $11,998,000 is planned for this expansion. These data apply to projects which were under construction in 1978 or budgeted and approved for expenditure (308 Survey).

Assuming 343 operating days per year as listed in the American Paper Institute (API) capacity survey, the planned daily capacity expansion reported in response to the 308 Survey equals 51,000 tons annually. Capacity expansion as reported in the API Survey from 1978 to 1982 is 376,000 tons annually (API Survey). The 308 Survey reported capacity expansion for the all other paperboard product sector is thus lower than capacity expansion reported by API.

Age and Productivity

Most mills in the all other paperboard product sector were constructed in the 1950's to the 1960's. There have recently been only a few new mills coming on-stream and a moderate number of new machines added. Productivity growth in this product sector is moderate (3 percent per year). The degree of technological obsolescence is low. (Discussions with DRI Pulp and Paper Service staff, August 2, 1979.) Capital investment during the past five years by mills producing in this product sector totals $721,869,000. Investment per unit capacity equals $33,000, which is moderately low compared to the industry as a whole. (308 Survey) (Note: High capital investment does not necessarily correlate with low-cost production.)

Employment

Meta Systems estimates that the all other paperboard product sector employed roughly 6,450 people in 1978. This represented approximately 2.6 percent of total pulp, paper, and paperboard mill employment. (Meta Systems estimates based on E.C. Jordan data.)

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